28 JULY 1960

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for economy in **Oil-filled cables**

Here is BICC's latest development in 33kV power transmission—the Ductless, Shaped-Conductor, Oil-filled Cable. Dispensing with fillers and built-in ducts, this new design is essentially one of economy in materials, resulting in reduced cable costs. A full range of joints and terminations has been specially designed by BICC for use with this cable.

D.S.O. Cables can be supplied with aluminium sheaths or reinforced lead sheaths and copper or aluminium conductors. Frequently the all-aluminium D.S.O. Cable (aluminium conductors and aluminium sheath) offers the most economical design.

BICC

DUCTLESS SHAPED-CONDUCTOR OIL-FILLED

DSO

33kV CABLES

Further information on D.S.O. Cables is contained in Publication No. 392—available on request.

BRITISH INSULATED CALLENDER'S CABLES LIMITED · 21 BLOOMSBURY STREET · LONDON · WC1

We are the largest manufacturers and suppliers of electrical insulating materials in the range we cover and the variety of our products

MICA ; block, splittings and fabricated parts.

MICANITE ; built-up mica insulation of every type in the form of sheets, tubes, cylinders, V-rings, covered bars, segment separators, fabricated parts, etc.

"SAMICA": mica paper insulation.

PAXOLIN ; synthetic resin bonded laminates having paper, fabric, glass, nylon, asbestos or other fillers are bonded with ethoxyline, melamine, phenolic, silicone or other resins to produce various grades for punching, moulding or machining.

SILICONE INSULATION ; a range of materials for Class H applications; silicone glass fabric, silicone bonded glass laminates, silicone bonded Micanite sheets, tubes, V-rings, etc., silicone glass/mica tapes; silicone combination insulation and silicone elastomer tapes.

EMPIRE VARNISHED INSULATION; paper, cotton, silk, Terylene, nylon and glass in the form of sheets and tapes treated with various impregnants including ethoxyline.

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"SAMICA" "PAXOLIN" and "PANILAX" are registered trade marks.

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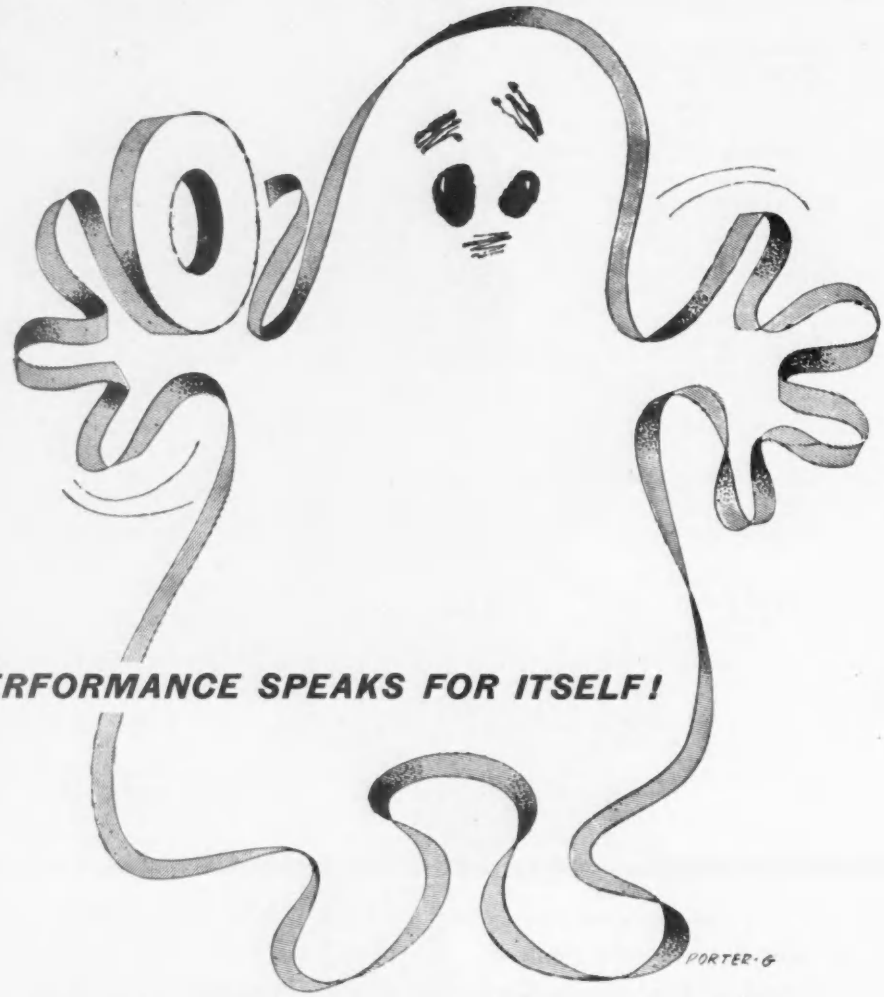

ITS PERFORMANCE SPEAKS FOR ITSELF!

Lasso No. 92 has so many properties, so many uses, we could fill this page with them. And dull reading it would make. A lot of stuff about pliability, water resistance, acid resistance, wrapping, jointing, insulating, binding, splicing — *that* sort of thing. Far better send for our alert young representative, *he* makes it sound interesting. Ask your secretary to drop us a line today.

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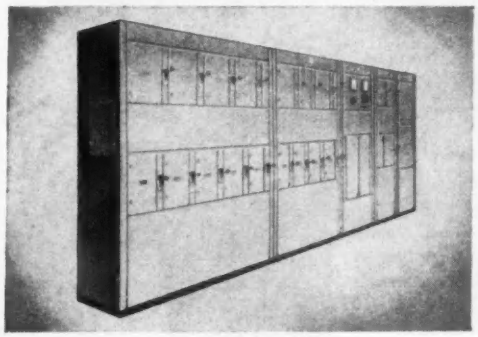
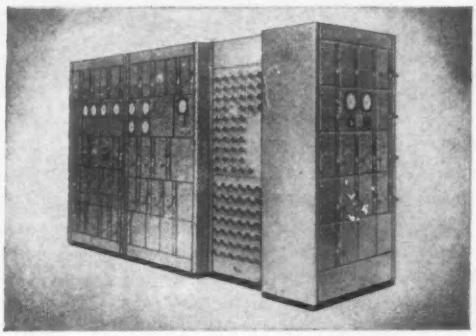
The Modern Switchgear – for Modern Buildings





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950 kVAr 380 volts
3 Phase 50 cycles
Assembled with HRC fused Therminol capacitor units of 25 kVAr

Conditions vary between different areas and from one type of installation to another and you are invited to discuss your electrical power installation with our technical staff. Free advice and if necessary a report and estimate will enable you to judge whether the conditions of power consumption in your plant are needlessly wasteful. Anticipated annual savings sometimes running into many hundreds of pounds will show just how soon the capital outlay is recovered by the increase in electrical efficiency. Thereafter you will enjoy a net saving through reduced electricity costs.

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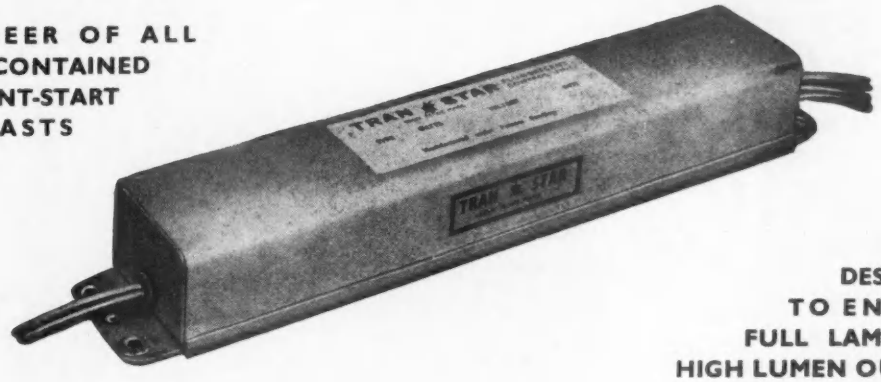

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UNIT AND CUBICLE CONSTRUCTION
SWITCHBOARDS

Illustration on right shows an indoor totally enclosed unit construction type "Y" switchboard with incoming duplicate busbars feeding common outgoing circuits by means of interlocked fused switches of both 300 amp and 500 amp capacity.

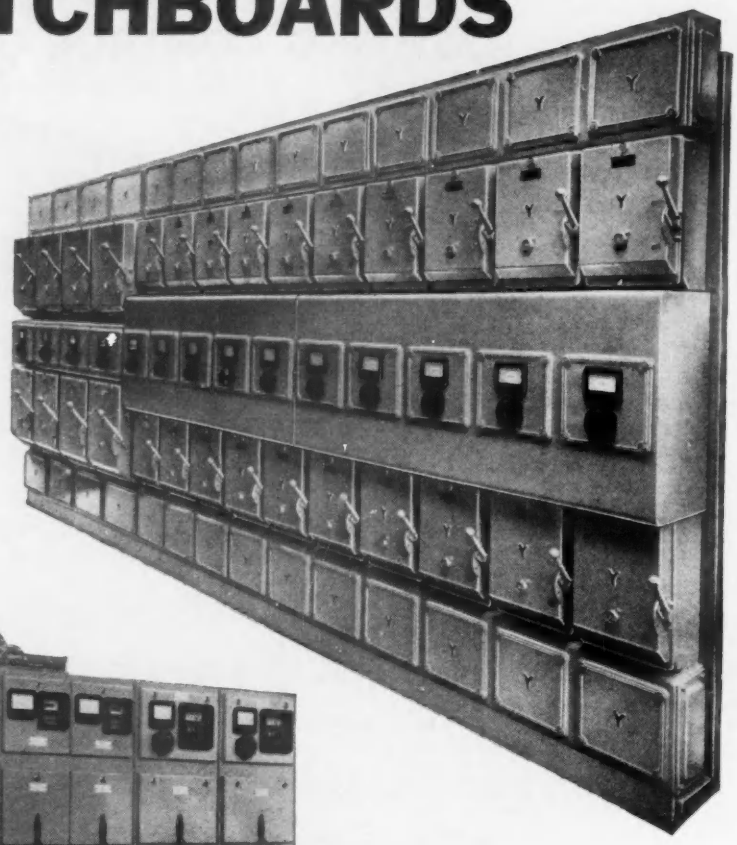
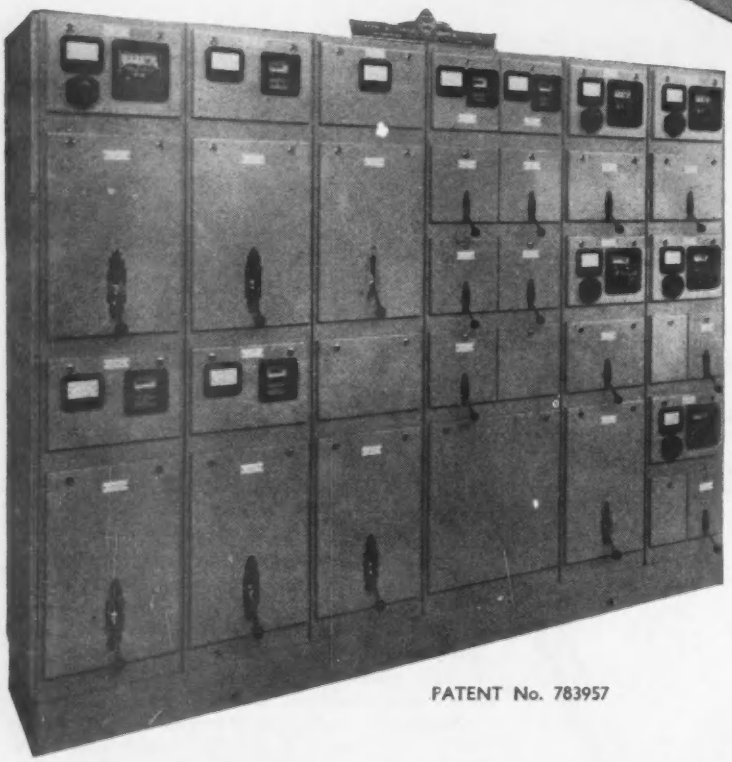


Illustration below shows an indoor all-isolating cubicle construction switchboard having individual metering on the outgoing fused switches of 60 amp, 160 amp and 300 amp capacity.



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It's aluminium

Sheathed in *seamless* extruded aluminium, this cable is lightweight yet strong. It needs no armouring, thus allowing simple cable design. With a high resistance to vibration fatigue, it can be used with complete safety, alongside railways etc.

It's flexible

Corrugation results in greater flexibility, permitting the same bending radius as a lead sheathed cable. Not only are handling qualities improved but corrugation reduces the required thickness of the sheath *by one half*.

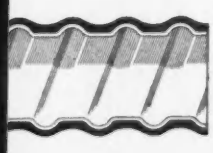
It's a money saver

Initial costs are therefore lower than conventional type cables of similar performance. Lightness and flexibility simplify transportation and installation. No special precautions are necessary to allow for expansion and contraction.

Further information is available on request.

It's the BICC C.S.A. cable

CORRUGATED
SEAMLESS
ALUMINIUM



PROTECTIVE SERVING

Anti-corrosion protection is provided by an extruded P.V.C. covering which fits tightly over the whole sheath surface. *See section view.*

INSTALLATION

Conventional installation procedure is followed. Jointing techniques are the same as for normal smooth aluminium-sheathed cables.

CABLE TYPES

C.S.A. sheathing is available with BICC Mass - Impregnated Non - Draining (M.I.N.D.) Cables up to 33kV and for Oil-Filled Cables.

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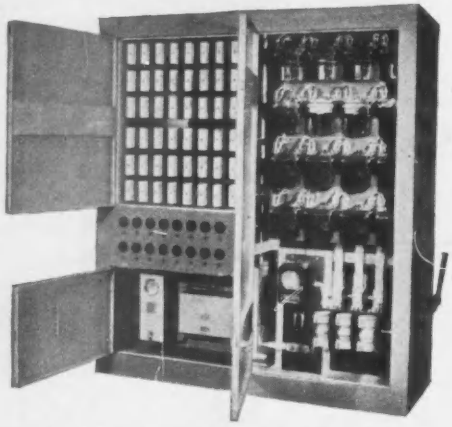
built to individual Specifications



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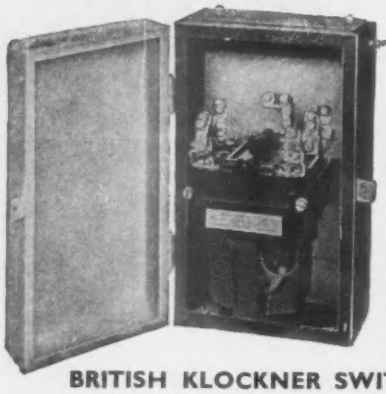
With the special off-peak tariffs now available through the electricity authorities the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

The panel illustrated handles 267 kW and is divided into 16 zones with individual limit thermostats and overall control by time-switch, together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.



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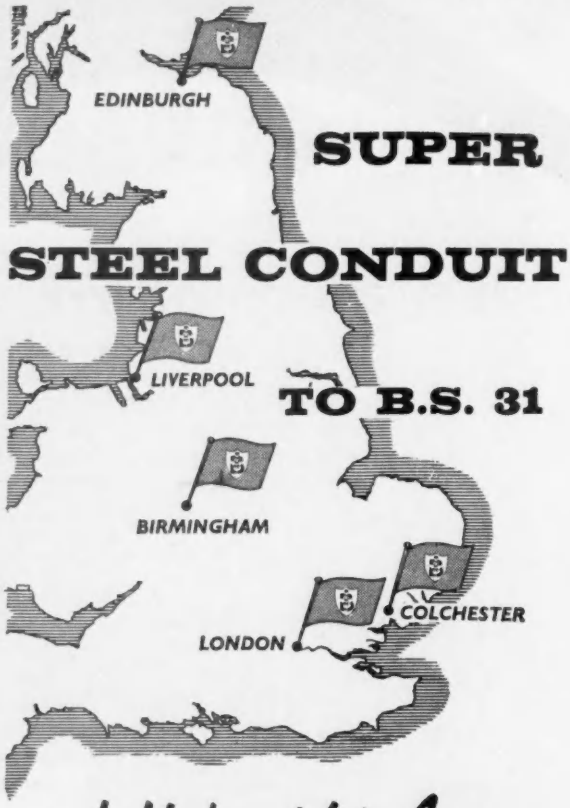

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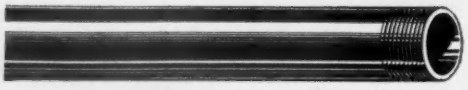

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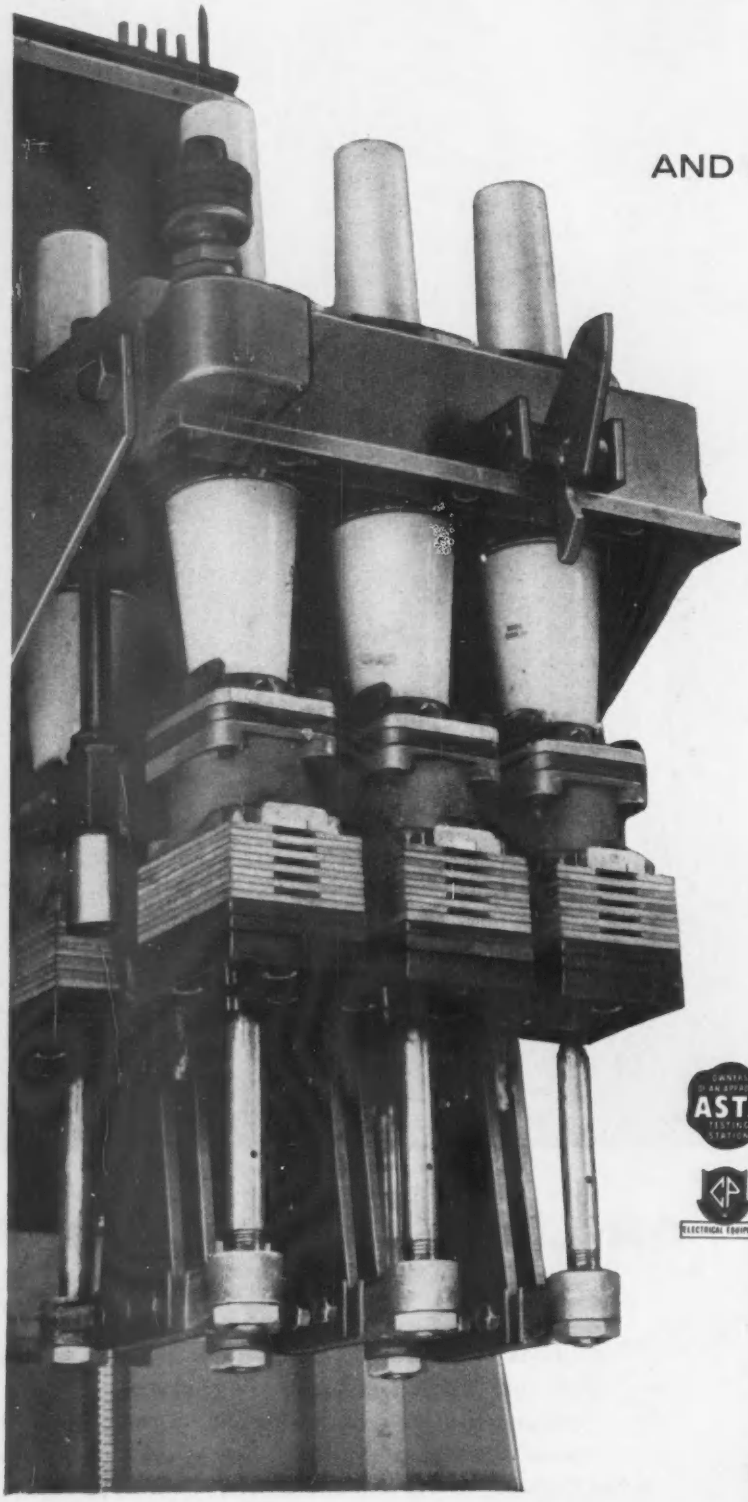

AND MAKING SWITCHGEAR

You, as an engineer, know that there can be no sharp dividing line between designing and building. A good design incorporates experience gained in making, testing and installing similar equipment in the past. And, of course, it is also shaped by the experience of all sorts of people using the earlier designs under a variety of conditions that could not be simulated in any test laboratory.

To a long-established company such as Crompton Parkinson this process of feedback of information to the designer is fundamental. It is the guiding factor in those details that defy specification but which, in aggregate, have so profound an effect on reliability and performance.

For example, the comprehensive ranges of Crompton Parkinson oil and air-break switchgear have been built up as the direct result of 60 years' experience in this field, backed by extensive development work in up-to-date research laboratories and an ASTA-approved testing station.

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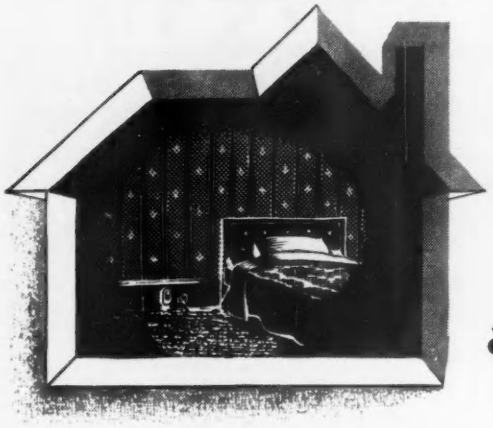
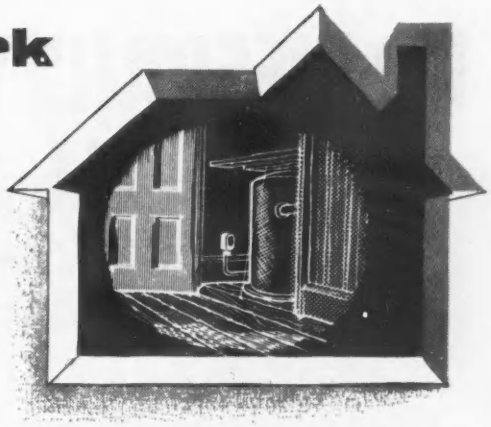
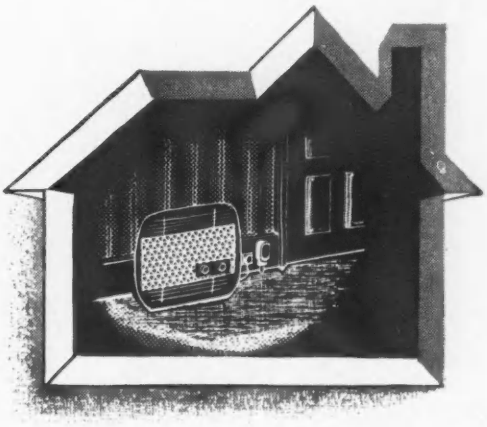
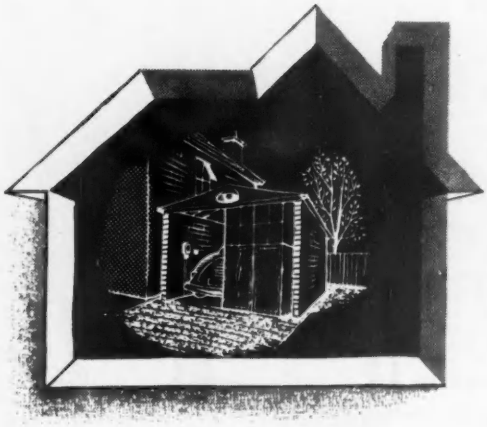


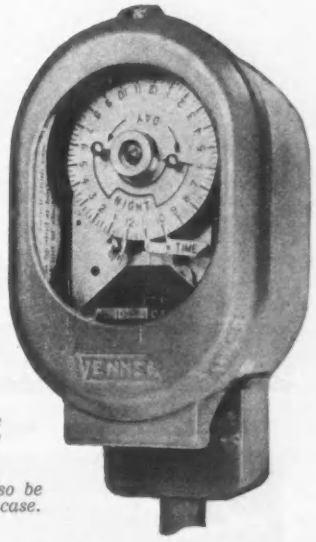




The average home today relies more and more on electrical equipment which can prove expensive if it is not properly controlled . . . immersion and under floor heating, for example. The Time Switch type MD1QP illustrated can switch an immersion heater off at night as well as on again in the morning while the family are still sleeping, saving power overnight but still providing hot water when it is needed. It can also control an electric blanket, porch or drive lighting, or a wireless set used as an early morning alarm.



Once set, the Time Switch needs no attention. The clock is electrically actuated; an external switch allows the appliance which it controls to be turned off when it is not needed. There are many variations of the Venner Time Switch, all described in our No. 1 series of leaflets, free on request.



A cable cover is available for conduit wiring. Rating 20 amps. 200/250v. A.C.

The Time Switch can also be supplied in an all-plastic case.

Venner Limited, Kingston By-Pass, New Malden, Surrey.
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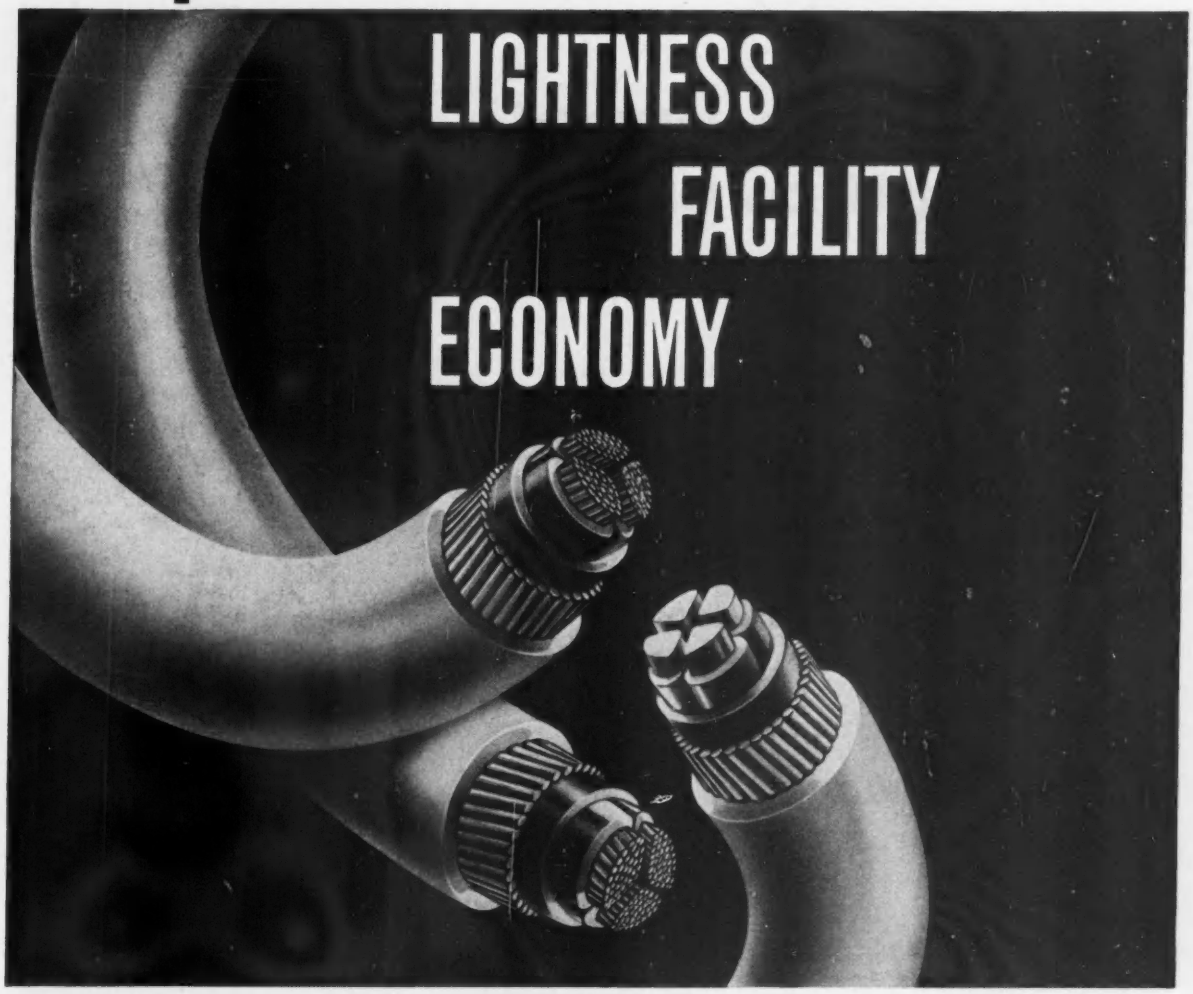

MERSEY offer SHAPED CONDUCTOR plastic armoured cables

Plastic insulated and sheathed armoured power cables with shaped conductors are now being standardised, and Mersey are producing a range of cables to the new Draft British Standard as well as to customers' special requirements.

Considerable advantages over the traditional paper insulated mains cable include reduced weight, non-hygroscopic insulation, and cheaper and simplified jointing procedure.

These cables are inherently less prone to damage and can be installed without fear of troubles due to migration of compound. Alternative designs are available with aluminium conductors and aluminium armour, and these can show the most striking savings in cost.

Very good reasons for going into further detail don't you think?

Then address your enquiries to Mersey.

MERSEY CABLES

the first choice of discerning cable users

Mersey Cable Works Limited, Liverpool 20. *Telephone:* Bootle 4111.

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Positive proof all over the world

Wherever the giant transmission lines stride across the land,

porcelain insulation is likely to be in evidence.

And the chances are that this porcelain insulation is by Taylor, Tunnicliff.

A few of the large variety of insulators we have

the capacity and knowledge to produce are shown in the illustration below.

No insulation problems are too difficult for us

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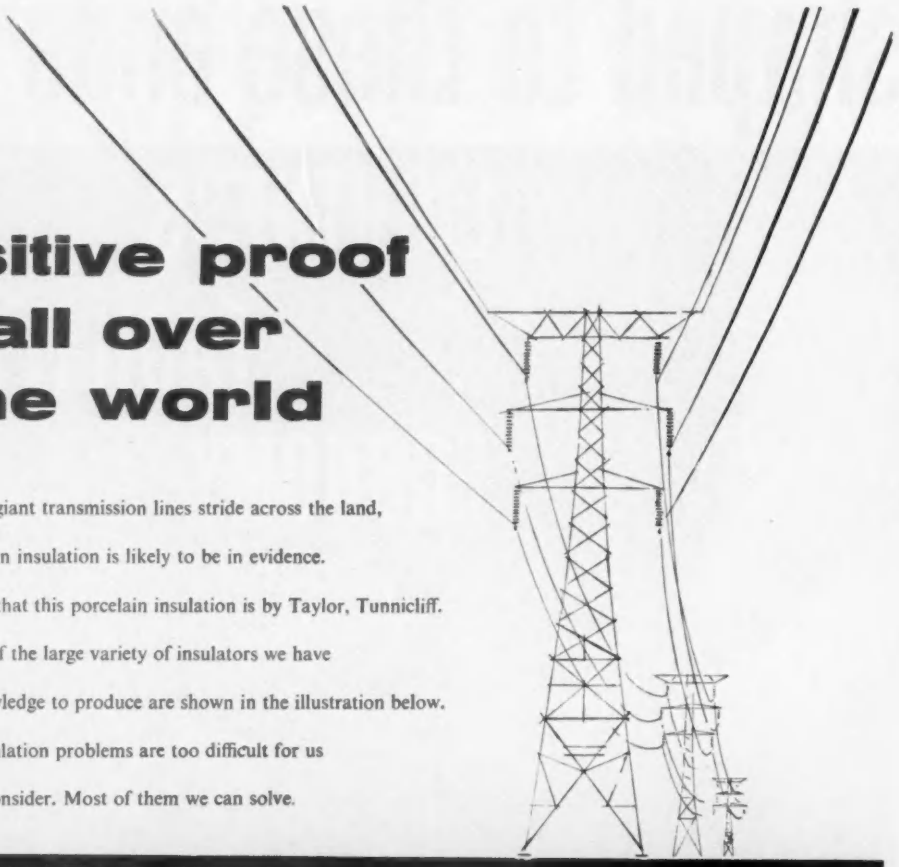

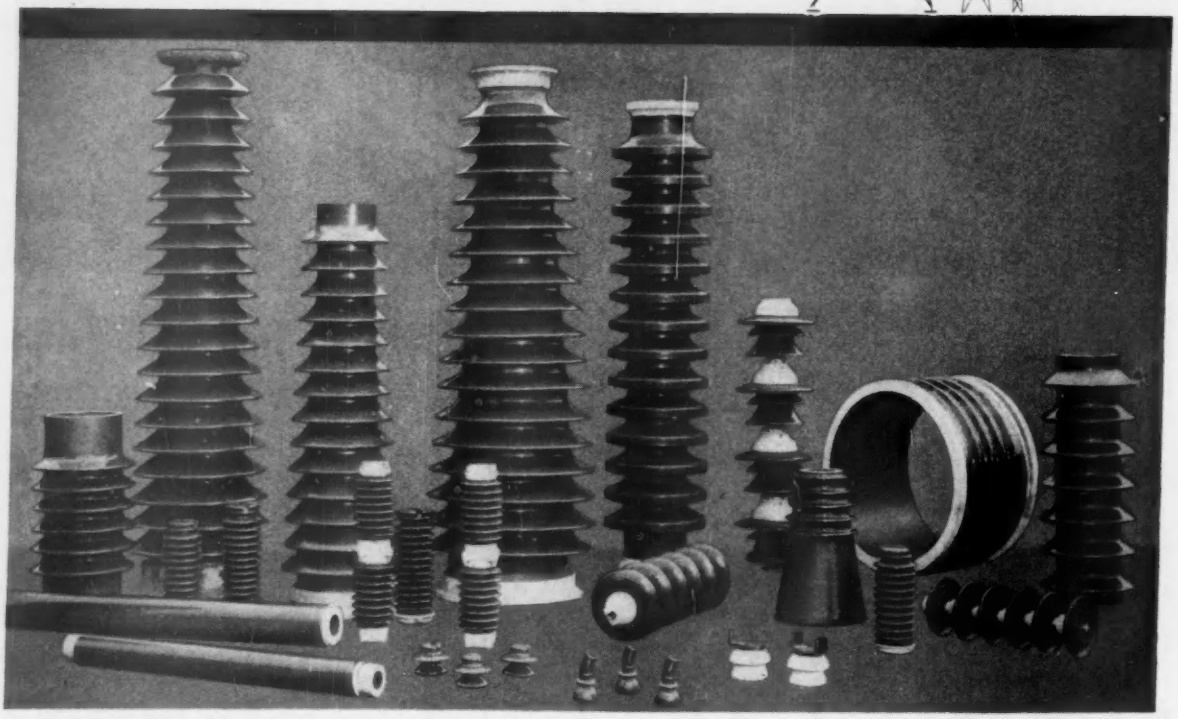

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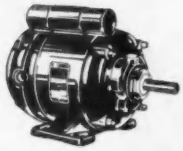

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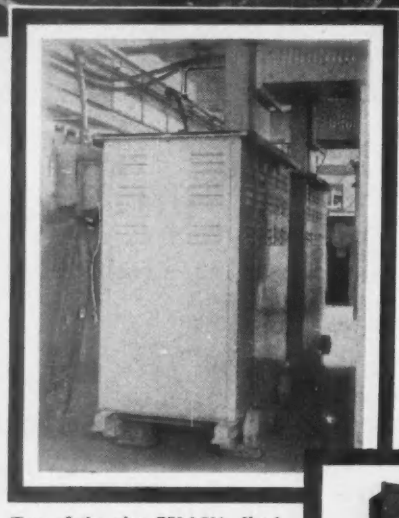
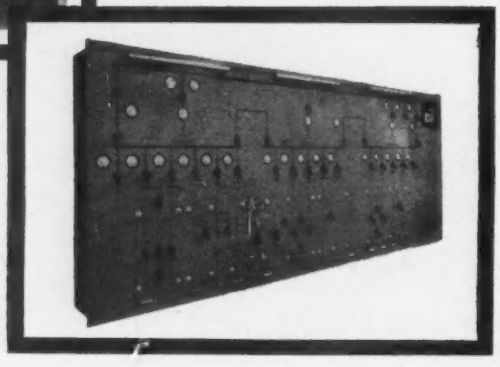
The newly opened B.B.C. Television Centre at the White City consumes considerable electric power and requires a safe and dependable supply. Brush Control panels have been chosen for the three control rooms located within the studio area, controlling both 11 kV and 415 volt supplies. Brush have also supplied nine 750-kVA Transformers housed in Substations on the periphery of the new circular building. These dry type Transformers with class 'C' insulation rely on surrounding air as the sole cooling medium and are able to withstand temperatures in excess of 180°C continuously.



Two of the nine 750 kVA distribution Transformers.



Brush Control Panel in the Central Apparatus Room.

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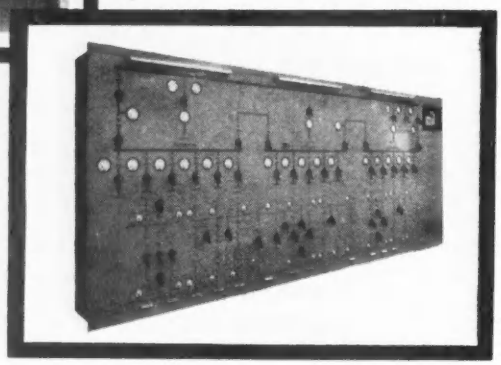

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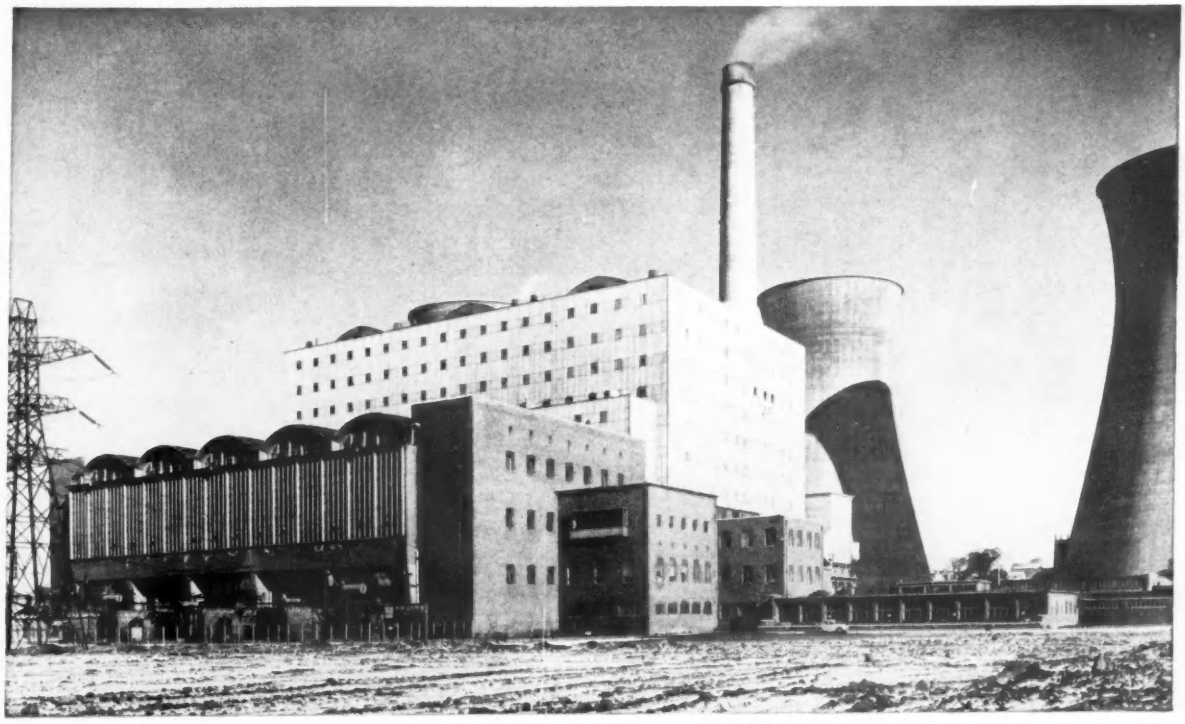
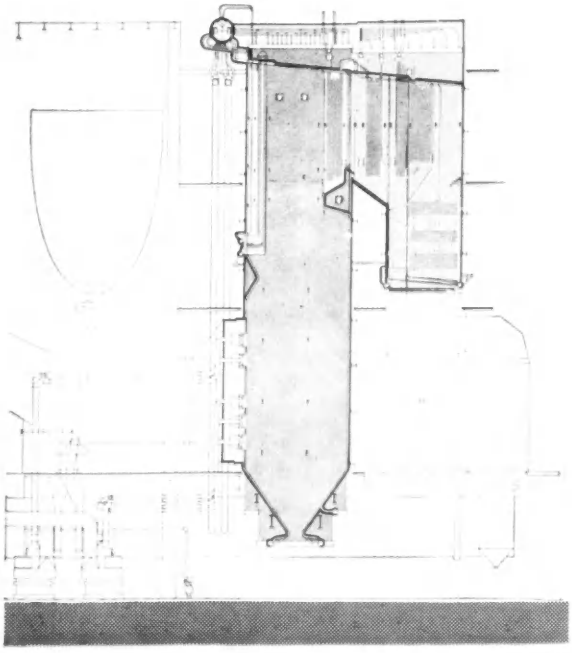


Ferrybridge 'B' power station;
Yorkshire Division, Central Electricity Generating Board

BABCOCK at *Ferrybridge 'B'*

STEAM-RAISING PLANT



THREE 760,000 lb./hr., P.F.-FIRED, RADIANT-TYPE, 'REHEAT' BOILERS, steaming 100 MW GENERATORS

The Ferrybridge 'B' power station is one of the first to be commissioned of the Central Electricity Generating Board's modern "reheat" installations; with its three Radiant-type reheat boilers, all supplied by the Babcock organization and each steaming a 100 MW generator as a single boiler/turbine unit.

The boilers, each with a capacity of 760,000 lb./hr. M.C.R., at 1,600 lb./sq. in. and 985 F final temperature, with reheat to 955 F, are pulverized fuel-fired by 20 horizontal circular-type burners supplied from five Babcock type 'E' pulverizing mills, per boiler. Other Babcock equipment includes the automatic lighting-up and low-load-carrying oil burners, the automatic, sequence-controlled system of " Unidirectional-drive" and rack-type soot blowers; and Bailey boiler controls.

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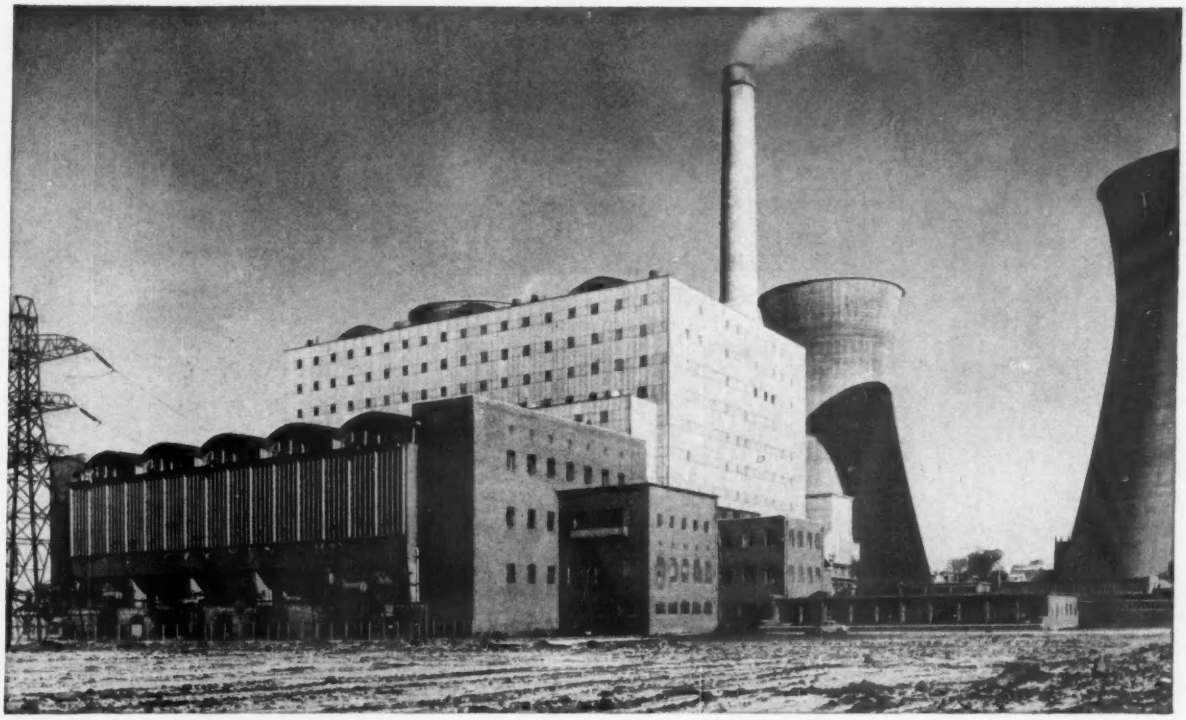

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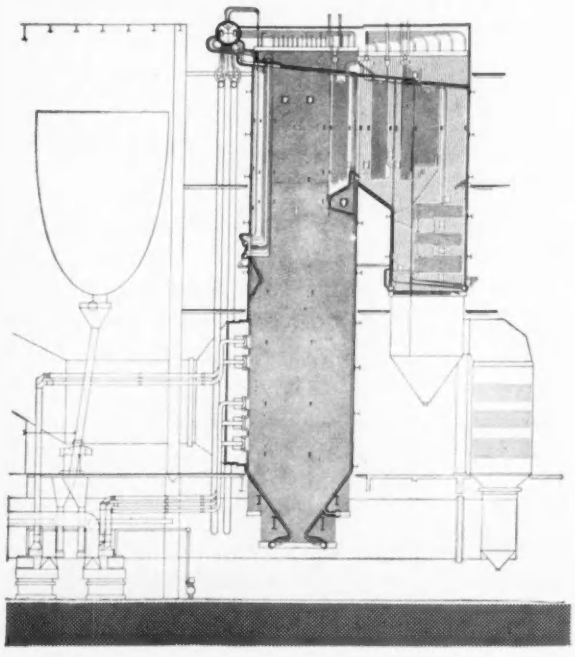

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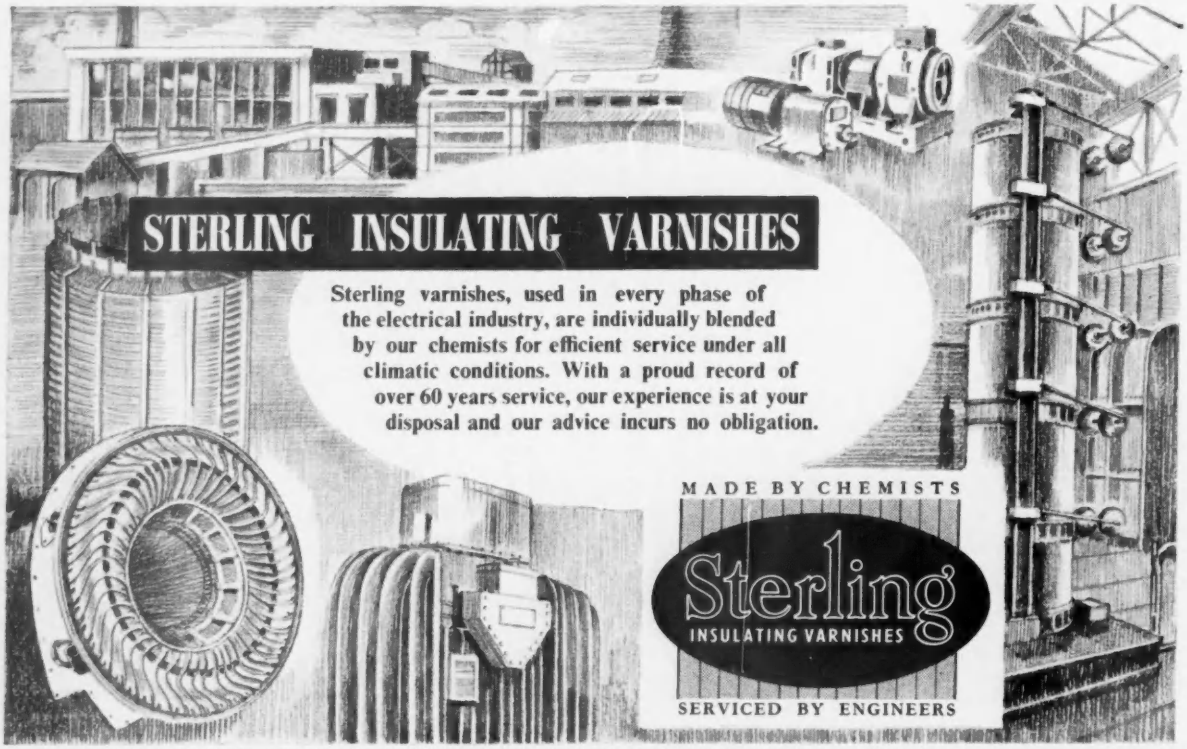

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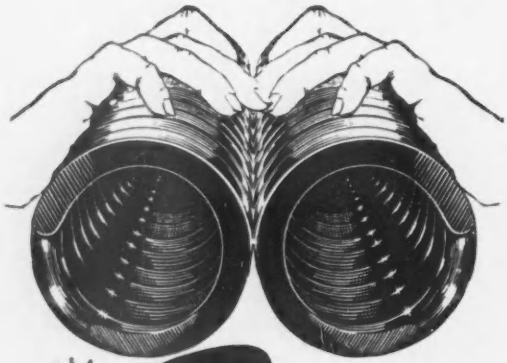

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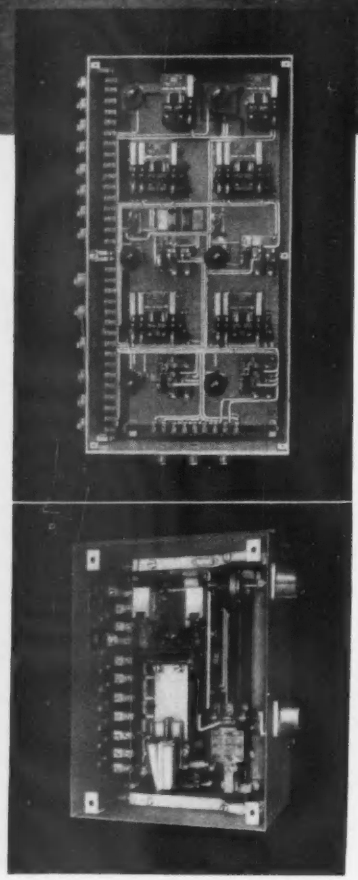

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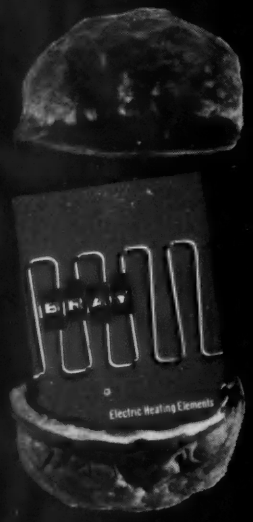

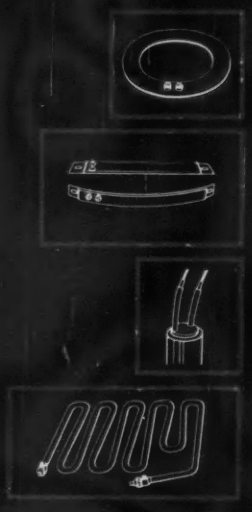

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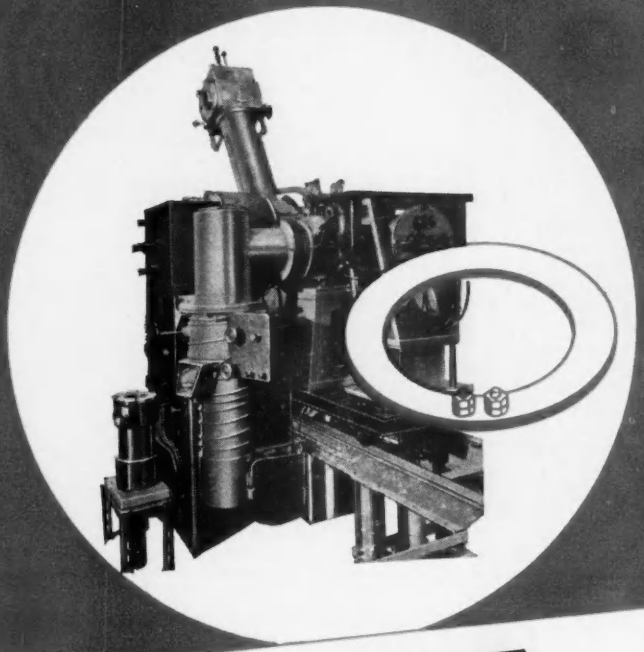

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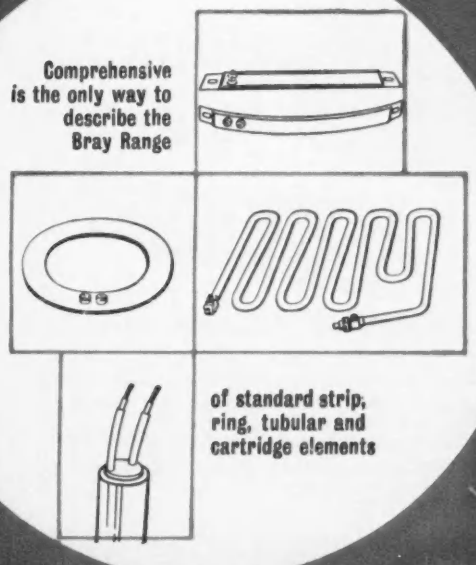

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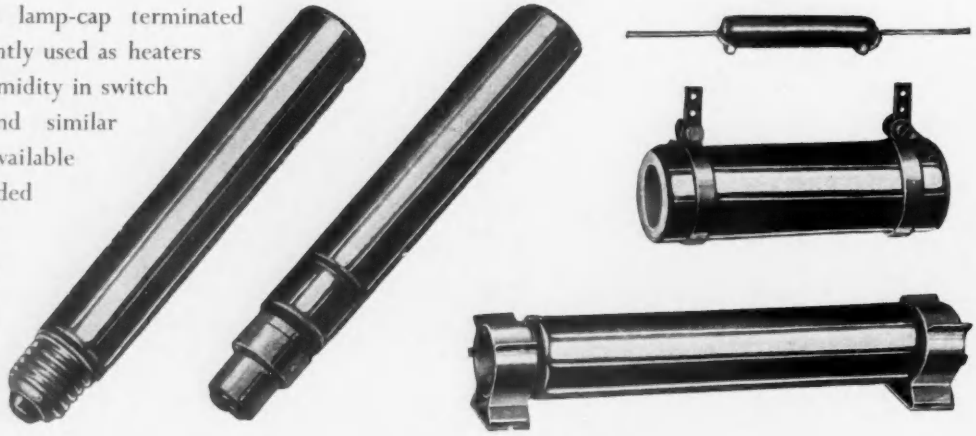

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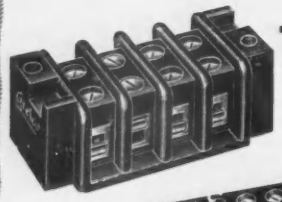

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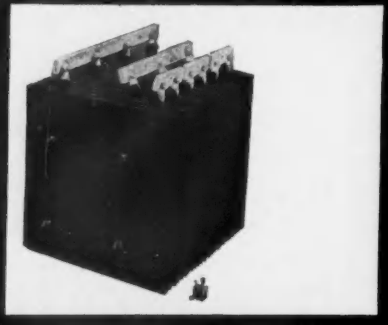

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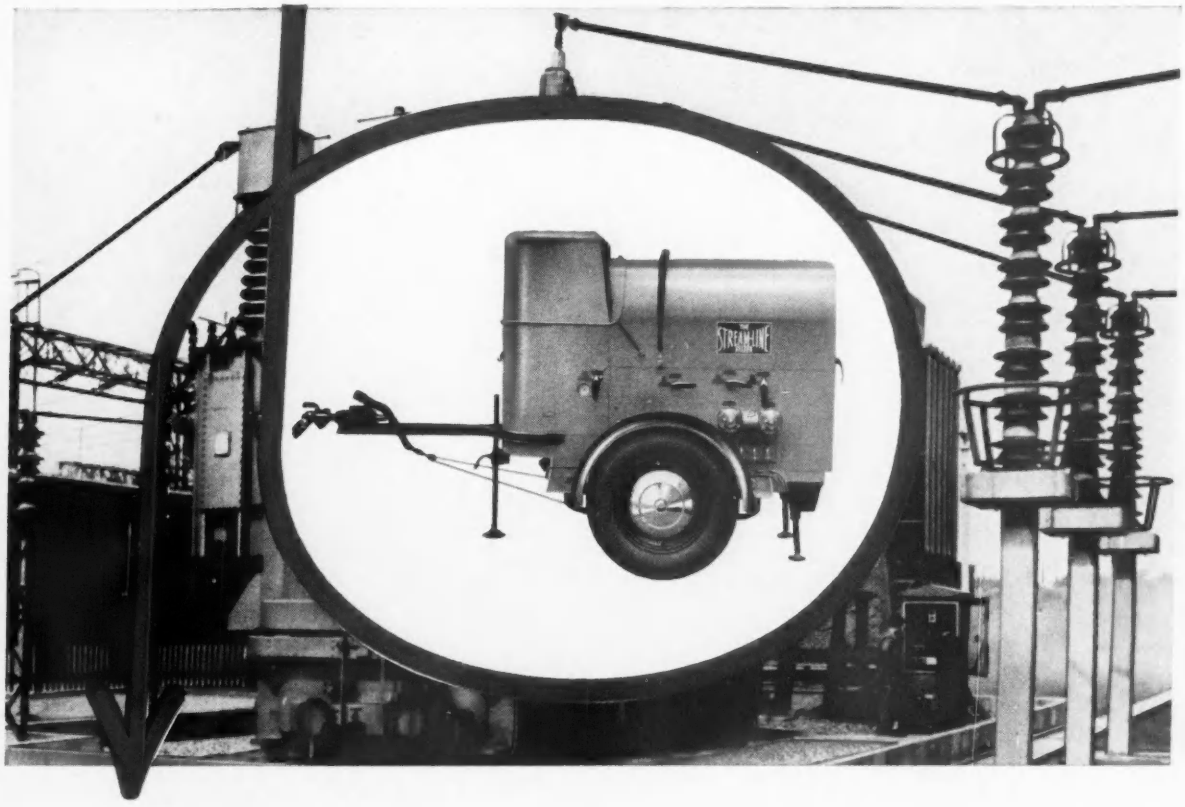
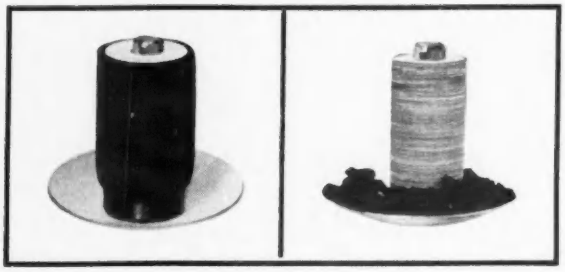


Loop in a Stream-Line filter



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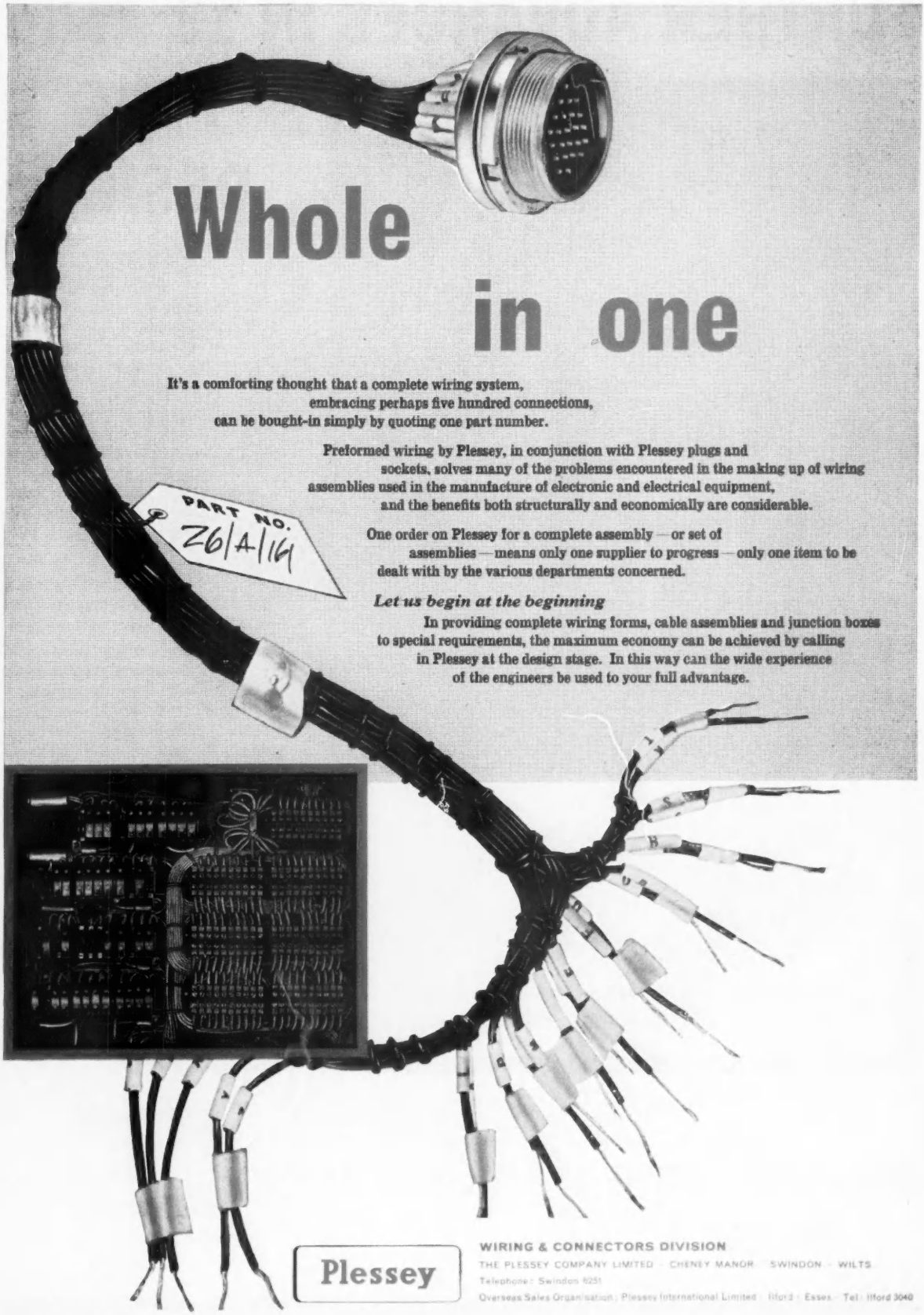

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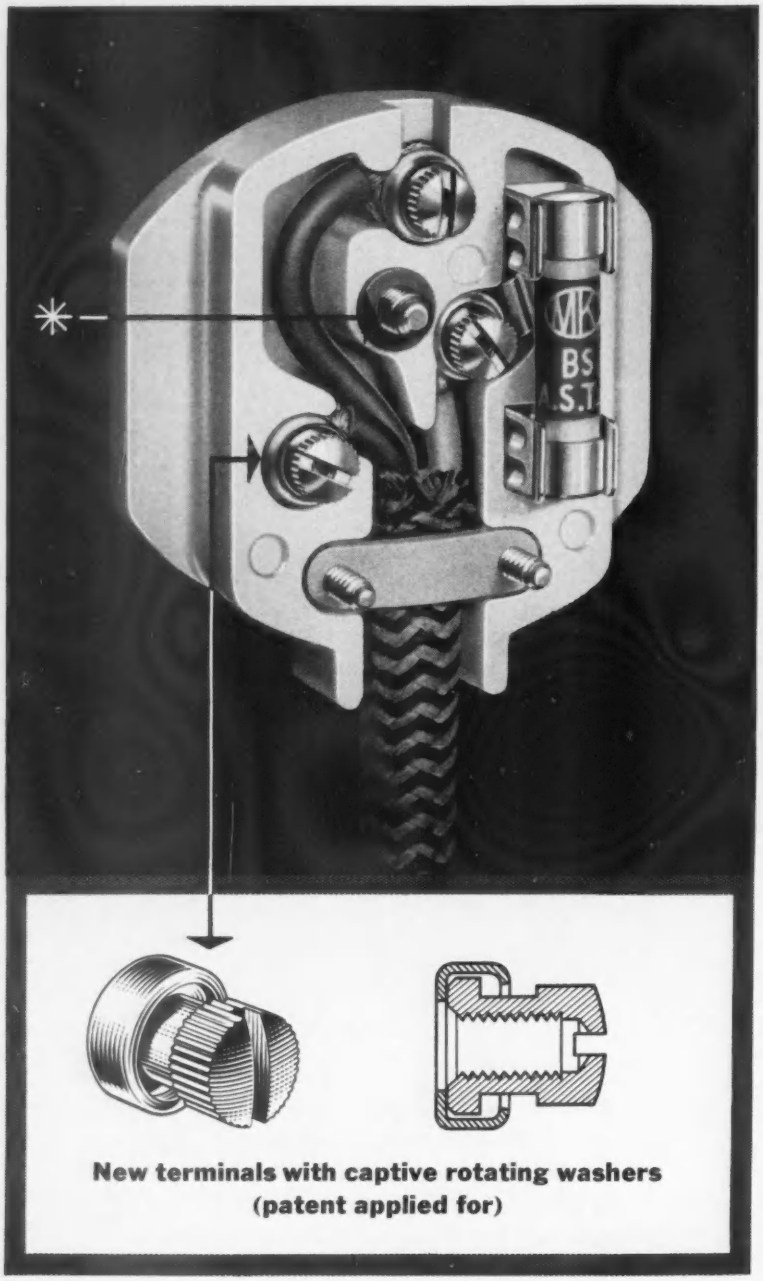

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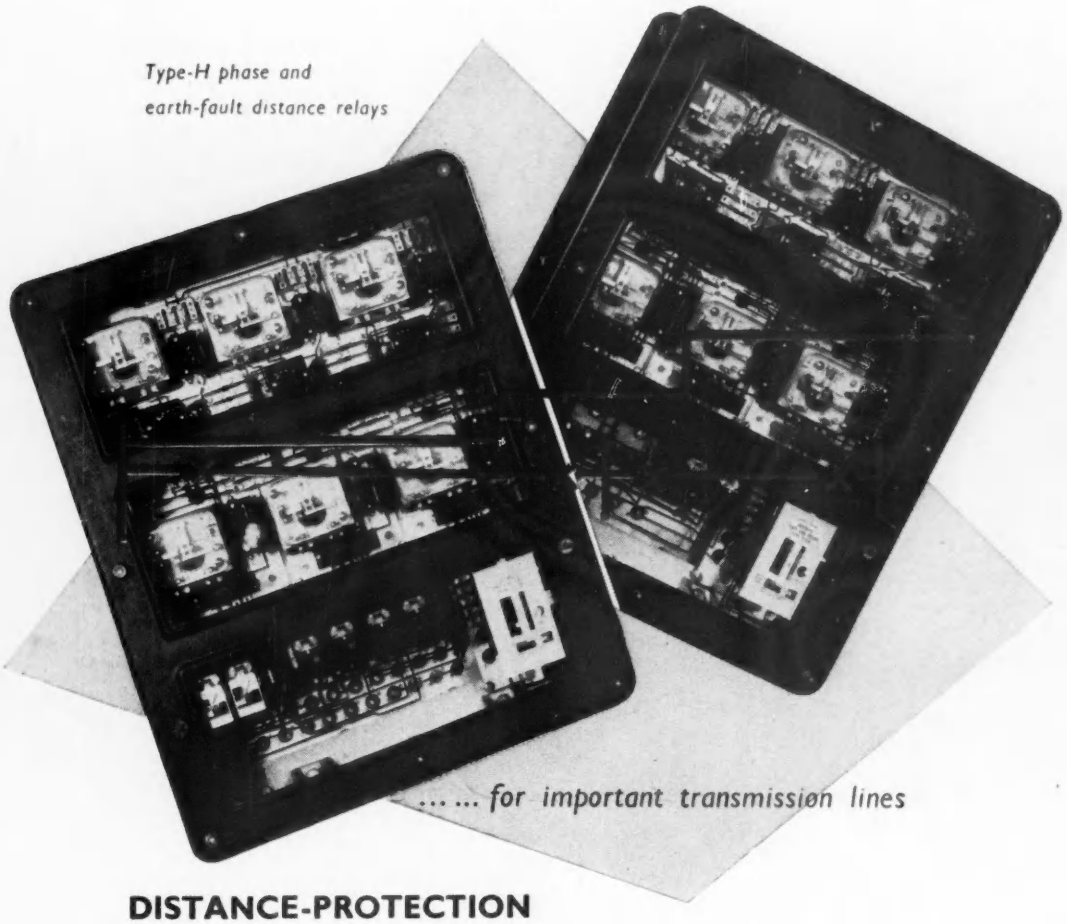

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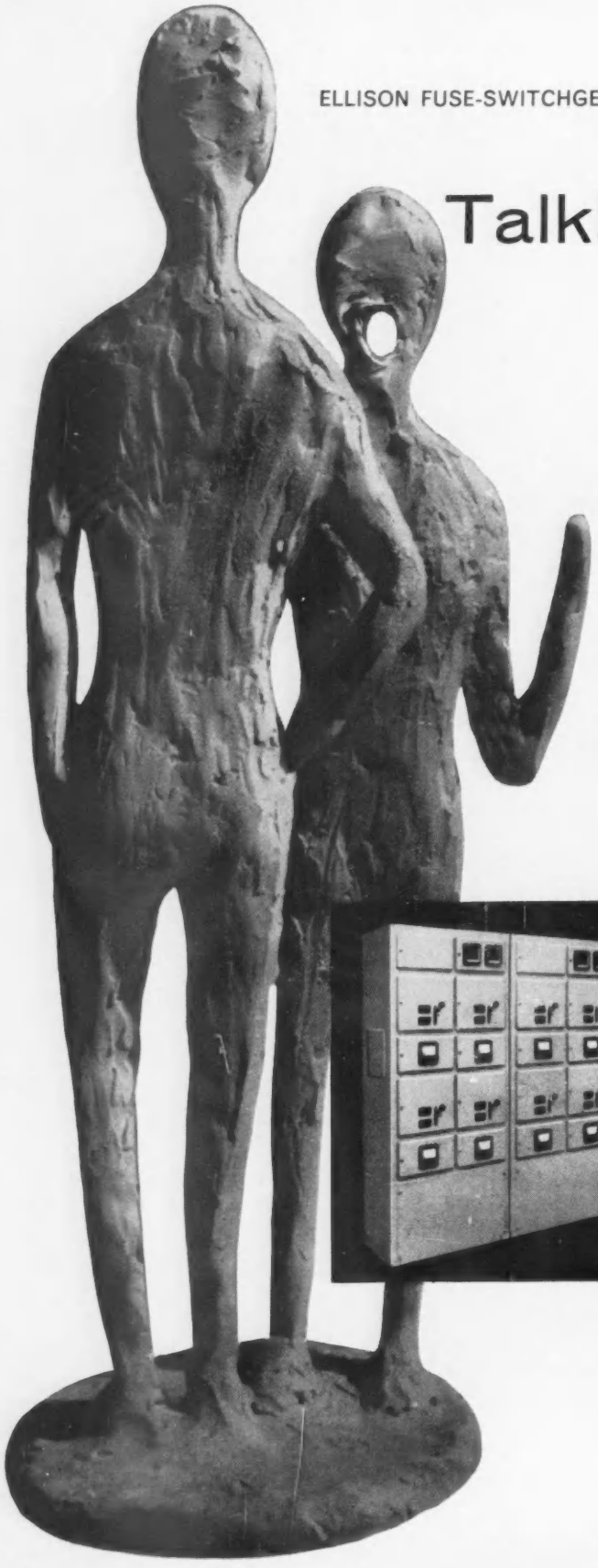

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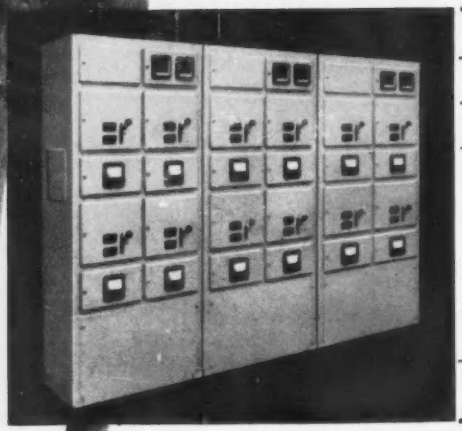

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Dans ce numéro

Destruction de l'artison au moyen de Champs Haute Fréquence 121

On a pratiqué des essais visant à utiliser des champs électriques à haute-fréquence pour détruire les artisons dans le bois. On pensait que l'on pouvait les détruire avec une légère augmentation de température qui n'affecterait pas le bois, à cause de leur plus grande conductivité, mais cela ne s'est pas produit; cependant, bien que l'application généralisée du chauffage à haute-fréquence ne soit pas possible, celui-ci demeure valable pour stériliser les boiseries sans les enlever des murs, ainsi que pour le traitement du bois de charpente débité, dans les chaînes de production.

Moteurs à Courant Alternatif pour Navires ... 125

Lorsque l'on choisit des moteurs pour circuits auxiliaires de navires, utilisant une alimentation en courant alternatif, il faut se rappeler que la capacité du circuit est relativement petite par rapport aux très gros moteurs qui lui sont connectés. Les courants de démarrage devront donc être réduits, mais cela justifie rarement l'utilisation de moteurs à bague collectrice plutôt que celle de moteurs à induction à démarrage direct. Il vaut mieux utiliser des alternateurs plus complexes et des moteurs à induction à cage double.

Etude de la Protection au CIGRE 131

Au cours du dernier CIGRE, on a fait plusieurs fois allusion à l'utilisation de dispositifs à semi-conducteurs dans les circuits de protection. En Belgique, on essaie actuellement un système de protection de comparaison de phase transistorisé. Un rapport Canadien étudie le comportement de relais Buchholz, et conclue qu'ils représentent un élément valable de détection des défauts à leurs débuts. D'autres orateurs ont fait des communications sur leur fonctionnement et leur conception.

In dieser Nummer

Bohrwurmvertilgung mittels Hochfrequenzfelder ... 121

Versuche wurden angestellt um die Wirksamkeit hochfrequenzer elektrischer Felder als Mittel zur Vertilgung von Bohrwürmern in Holz zu erproben. Man hatte angenommen, dass die Abtötung mit einem Temperaturanstieg gelingen würde, der dem Holz keinen Schaden zufügt, da die Bohrwürmer eine wesentlich höhere Leitfähigkeit besitzen als das Holz. Diese Annahme erwies sich jedoch in der Praxis als nicht stichhaltig. Wenn auch die Hitzebehandlung in Hochfrequenzfeldern somit als ungeeignet für den allgemeinen Gebrauch gelten muss, so kann sie doch von Nutzen sein zur Sterilisierung von Holztäfelungen an Ort und Stelle sowie zur Behandlung von Bauholz in Sägemühlen.

Schiffs-Wechselstrommotore 125

Bei der Wahl für Schiffs-Hilfsgeräte geeigneter Motore ist darauf zu achten, dass beim Anschluss an einem Wechselstromsystem die Kapazität des Systems immer klein im Verhältnis zu den grössten ihm angeschlossenen Motoren ist. Der Anlasstrom muss daher unter solchen Umständen niedrig gehalten werden. Diese Erwägung rechtfertigt jedoch selten die Wahl von Schleifringmotoren statt direkt angelassener Induktionmotore. Demgegenüber empfielt es sich, an sich kompliziertere Wechselstromgeneratorsätze und Induktionsmotore mit Doppelkäfigrotor zu verwenden.

Schutzmassnahmen als Diskussionsthema auf der CIGRE-Tagung 131

Auf der neulich abgehaltenen CIGRE-Tagung wurde vielfach auf die Verwendung von Halbleitervorrichtungen in Schutzkreisen hingewiesen. Gegenwärtig wird in Belgien ein transistorisiertes Phasendifferenz-Schutzsystem erprobt. Ein Bericht aus Kanada geht auf das Verhalten von Buchholzrelais ein und vertritt die Meinung, dass sie ein wertvolles Mittel zur frühzeitigen Aufdeckung von Betriebsstörungen darstellen. Andere Diskussionsteilnehmer äusserten sich zu einzelnen Fragen im Zusammenhang mit dem Betrieb und der Konstruktion solcher Relais.

Vive le new Power Alliance!

Contracts for the manufacture and laying of the cross-Channel submarine power link have now been placed by the Central Electricity Generating Board and Electricité de France

'Ooray for British Cable!

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 28 JULY, 1960

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News Editor:
T. W. WRIGHT

Comment

R.P.M. OPINIONS

With the Restrictive Practices Court ravaging its way through the structure of orderly trading in this country, the right of enforcement of resale prices by individual manufacturers is one of the few defences remaining against the worst extremes of price competition. Currently, resale price maintenance is under trial, with a formal BoT inquiry in progress. At the heart of that inquiry is a sampling survey of the opinions of traders which is being based on 8,000 questionnaires to manufacturers, wholesalers and retailers. Clearly, the questions asked and the way in which they are framed is of importance to the fairness of the inquiry. It is a relief to find, following discussion in the House of Commons, that the questions do not merely seek out information on the way resale price maintenance is practised and enforced; they also recognise that there is a case for its continuance. Retailers are asked to what extent they find price fixing or price "suggestion" in operation for the goods they handle, and what happens to them if they ignore the fixed prices; but they are also questioned in some detail on after-sales service and what it costs, and how the amount given varies between price fixed and free competition goods. Answers to this section of the questionnaire, provided sufficient retailers of all sorts are willing to sort out some rather complex wording and an ill-designed answer form, should show just how vulnerable after-sales service for technically complex goods is to untrammelled price competition at the retail level—and experience elsewhere suggests that the rate of deterioration in service is likely to be faster, once all RPM is banned, than retailers imagine. It is regrettable that an inquiry of this sort was not attempted before the effective section of the Restrictive Trade Practices Act on agreements was drafted. It might have indicated for industrial, as distinct from consumer, goods how much store those most intimately concerned placed on orderly trading.

RAIL ELECTRIFICATION MERITS

To illustrate their criticism that the British Transport Commission does not pay enough attention to financial estimating in developing its modernisation plans, a Parliamentary committee that reported last week picked on the Euston-Manchester-Liverpool electrification scheme for detailed consideration. Their conclusion that on the original estimates the scheme did not give a worth-while return on the capital necessary to carry it through could be read as a verdict against electrification; but more extended study of the report shows rather the opposite. Apart from an explicit statement that there is no reason why the London Midland

electrification scheme should be abandoned, the committee report extensive evidence on the striking way in which electrification of the railways attracts passengers. Because they are not working yet, it of course had no figures for the 25 kV a.c. main-line schemes, but for the nearest recent equivalent, the Southern Region's electrification of its former steam services to the Kent coast, the results have been impressive. Expected to give an increase of £900,000 in annual receipts compared with steam services, attainable only after some years of running, the equivalent of a £600,000 a year increase in fact seemed even certain for the first year on the basis of the first few months. The consequent "expectation that the estimate will be handsomely overtaken by the actuality" is not confined to that scheme alone. Electrification of the Shenfield-Southend line is noted to have resulted in a trebling of passenger journeys in three years, despite fare increases. Although the committee has some reservations about the extent to which the costs and prospects of dieselisation have been compared with those of electrification, it is clear that they accept the BTC faith in electrification.

AMENITY PROTAGONIST

In the formal inquiries which the supply industry so often has to satisfy when it wants to extend its system, the Council for the Preservation of Rural England is usually to be found represented amongst the objectors. How that society views its relations with the electricity boards comes over more clearly from the annual report than from isolated statements on individual cases; and the electrical section of this year's report is longer than any other. Although differences of opinion occur, the impression it gives is of excellent relations with the CEGB; but of less uniformally good terms between CPRE and individual area boards. With regard to some boards, there is in the report an air of sweet reasonableness (the NWEB seems a particular favourite), while others are represented as being less willing to spend money on amenity. CPRE policy tends towards some central fund to provide for undergrounding, with pressure by the Electricity Council on the boards to use the money—but the report is most emphatic that the CPRE has no claim for undergrounding of 275 and 132 kV lines. On this point, the forthright disclaimer that is made must be respected, for there has been a widespread impression to the contrary. Certainly, the effective admission that such a step is impracticable will be welcomed by engineers, who will hope that it will spread to CPRE members and those of similarly interested organisations, as well as to their committees and officials. That does not lessen the reasonableness of the Council's appeal for strenuous efforts in research into undergrounding.

BODY CONTROL

By their very range and number, the lectures and papers delivered to the Third International Conference on Medical Electronics during its week-long session in London ending yesterday must impress the engineer as a layman in medical matters. Used as he is to the ever extending versatility of electronic control and instrumentation, its application to medical subjects carries an aura that is unique and intriguing. Yet remarkable as are the achievements reported, the hopes for the future read more strikingly still. That which most strongly seizes the imagination is Dr Zworykin's concept of an electronic computer centre as a bank for a complete population's medical records. This offers the prospect that a regular check on key health parameters, automatically controlled with previous readings, would early reveal the onset of pathological conditions; but perhaps it has overtones of Big Brother potentialities. More completely free from objection and wholly beneficial are the ideas for replacing more and more of the "essential" organs by electro-mechanical devices enabled by electronics techniques to operate within the fine limits necessary to the maintenance of life. In such a field of activity, where two technologies of quite different origins and traditions come together, meetings organised by professional bodies have an enhanced importance, whether they are small informal gatherings like the IEE's medical electronics discussion group, or a major occasion attended by representatives from all over the world.

FALLEN NUCLEAR IDOL

What is happening to thermonuclear research, so recently through ZETA the apparent pride of the UKAEA? The recent UKAEA report had quite a lot to say on the subject—but it seems clear that thermonuclear power, at least through the toroidal pinch techniques used in ZETA and SCEPTRE, is becoming a more remote possibility than at first appeared. Although during 1959 both the stored energy supply and the magnetic field supply for ZETA were increased by no less than six times, and discharge currents of 800,000 amps obtained, there was no improvement in the essentials of time for which the gas was kept clear of the containing walls, nor of the gas temperature. Intensive theoretical studies of the problem have pointed the need for rates of rise of current still faster than those obtained with ZETA. This is one of the main objects of the design of the ICSE apparatus which is to be erected at a new UKAEA establishment. And this apparatus is even more fundamentally experimental than is ZETA; the report describes it bleakly as essentially a large-scale experiment in plasma physics, and warns that the sought-after hydromagnetic stability may not be obtained even in this equipment. What has emerged is that the boundless promise of energy riches which is inherent in the whole idea of controlled thermonuclear reactions is still guarded by a formidable dragon of fundamental mysteries and technological difficulties, which is going to take hard and patient investigation to overcome. The quick assault originally envisaged has failed comprehensively.

Meteor

This week's quick summary of electrical news faces advertisement page 16

Wood-worm destruction by h.f. fields*

by A. Morris Thomas, B.Sc., F.Inst.P., M.I.E.E.

WOODWORK, often of high artistic if not intrinsic value, as, for example, oak panelling and furniture, is sometimes in danger of damage and even destruction by the activities of "wood-worms." These creatures are, strictly speaking, "grubs" or "larvae" which are hatched from eggs deposited by the female adult beetles in cracks in the wood or in holes previously bored by the insects. The larva feeds and grows inside the wood, eating its way in various directions and so forming tunnels and burrows, without, however, emerging from the surface of the wood, except by accident. It is during this period that the wood suffers damage. The larval stage lasts for a year or more and then the larva transforms into a pupa or chrysalis, becoming completely inactive for several weeks. At the end of this period an adult beetle emerges from the pupa and bores its way out of the wood to pair and complete its life history. The worm-holes, which show on the surface of the worm-eaten wood and the frass, or powder, which is found in and below the holes are not, in general, made by the larvae but by the adult beetles when they bore their way out. The life cycle of woodborers is of the order of one or more years, depending on the species. In some cases much damage can be done to wood without very obvious external indications and, with severe infestation, wood can be reduced almost to the condition of powder or dust with only a thin outer shell remaining, held up by a fragile, internal, honeycomb structure.

In general, the most effective method of combating wood-worm infestation is by exposure to a high temperature (about 57°C or 135°F) in ovens or kilns under conditions of high humidity. It takes several hours for wood of substantial thickness to reach a uniform temperature throughout when placed in the kiln at the required temperature. The process cannot be accelerated by using higher temperatures because of the risk of thermal damage to the wood itself.

In recent years the development of dielectric heating by radio-frequency fields has suggested an obvious alternative to kiln heating for the sterilisation of wood which, at first sight, might be expected greatly to reduce the time required and perhaps be more economical in other respects. The wood-working industries already make good use of dielectric heating for gluing and bonding and no new principle is introduced in extending the process to sterilisation.

The insect pests which infest biological materials have usually a higher electrical conductivity and permittivity than the host and, when exposed to high frequency fields of sufficient intensity, they experience an increase of temperature which kills them through absorption of electrical energy from the field. This occurs even though the organism is wholly buried in material of low conductivity. The heating currents in this case are capacitative and, in general, their intensity increases with frequency at constant voltage amplitude. Such currents are non-existent with d.c. and negligible with low frequency a.c.; hence high frequencies are essential.

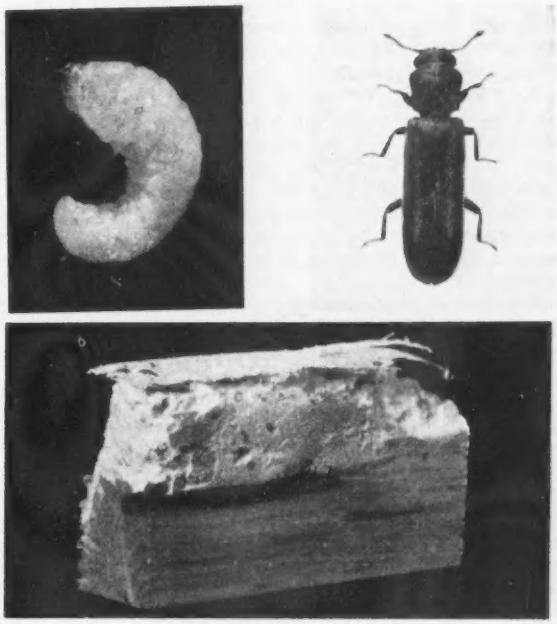


Fig. 1. Larva and adult insect of the powder-post beetle (Lyctus Brunneus) with, below, an oak test block showing damage

Lethal Effects of H.F. Currents

It is often difficult for people with no special knowledge of electricity to understand the unique characteristics of high frequency in this connection and sometimes there is a tendency to imagine that a kind of "death ray" is involved. There have been claims that it is merely the high frequency field itself which is lethal without regard to the field intensity. The truth is, of course, that the frequencies in question, of the order of megacycles, are very low compared with ionising electro-magnetic radiations which might, perhaps, be legitimately regarded as "death rays." All the valid experimental evidence is in favour of the conclusion that the lethal effect of megacycle high frequency fields is of a purely thermal character.

The investigations to be described in the following were carried out to determine the precise values of field intensities, times of exposure and temperature rise required to destroy insect life infesting wood and so to find if the high frequency method merited development on a commercial scale. The account given is a short version of ERA Report Ref. W/T37 which has been published in full elsewhere.[1]

*Based on ERA Report, Ref. W/T37.

Experimental Details

The test material used consisted of blocks of the sapwood of oak infested with the species *Lyctus Brunneus*, the members of which are commonly known as powder-post beetles (Fig. 1). This species was chosen because it is easy to breed under controlled laboratory conditions. *Lyctus* beetles were allowed to attack oak test blocks 2 in. by 1 in. by ½ in., one pair of beetles to each cu in. of wood, under constant ambient conditions, 25°C and 75% rel. hum. The test blocks were then incubated under the same conditions for ten weeks, sufficient to ensure that the larvae were fully grown when used for test purposes. The larvae vary in length from about ⅛ in. to ¼ in. and the worm-holes are about $\frac{1}{12}$ in. diameter or less. An average-sized larva recovered from a control block weighed 0·63 mg.

Before exposing the test blocks to the h.f. field, a hole of 0·040 in. diameter was bored down the centre of the block parallel to the grain from the 1 in. by ½ in. face, to a depth of 1 in. This enabled a temperature measurement* inside the block to be made by means of a hypodermic-needle thermo-junction which was inserted immediately after the exposure. In some cases a set of such holes was drilled in order to find the temperature distribution in the block.

The h.f. field was obtained from a generator which is supplied commercially for small-scale dielectric heating applications. This generator normally is capable of supplying about 200 watts of h.f. power at 75 Mc/s, but provision was made for conversion to 37.5 Mc/s if required. A "Variac" was added to the circuit to facilitate variation of the amplitude of the h.f. voltage. The latter was measured by means of a conventional capacitative potential divider and a rectifier peak voltmeter incorporating a germanium diode. This peak voltmeter was calibrated by two different methods which gave fair agreement. It was concluded that the absolute value of the voltage amplitude was determined to an accuracy of ±10%; relative accuracy was higher.

Tests were made with both transverse and stray fields, the latter being produced when both electrodes are applied to one surface only of the test block (Fig. 2).

Tests with Transverse Fields

Tests were first made by exposing the prepared oak test blocks to transverse h.f. fields. The blocks were arranged in stacks of four, giving a 2 in. thickness of wood, between copper sheet electrodes placed on the upper and lower surfaces. Applied voltages to give mean potential gradients in the wood ranging from 190 to 1,500 V (r.m.s.) per cm were used; the times of voltage application varied from 5 to 40 secs.

A series of preliminary tests was made with sound oak blocks to check the relation between the variables.

The equation for temperature rise, on the assumption that, in the short time available, there is negligible loss of heat, is:

$$\theta = 0{\cdot}24E^2\sigma t/sd$$

where θ=temperature rise in °C.
E=applied field in volts (r.m.s.) per cm.
σ=h.f. conductivity of wood in ohm^{-1}, cm^{-1}.
t=time of voltage application in seconds.
s=specific heat of wood.
d=density of wood in gr/cm^3.

A plot of measured values of θ as a function of E^2t is given in Fig. 3. In accordance with expectation the points lie approximately on a straight line which extrapolates to the origin. From the slope of the line it can be deduced that $\sigma = 5{\cdot}8$ by 10^{-6} ohm^{-1}, cm^{-1}, which compares with 10 by 10^{-6} ohm^{-1}, cm^{-1}, found by other authors by more precise methods[2]; the difference is probably due to variability in the characteristics of oak.

In the main series of tests on infested oak blocks, post-mortem examination revealed that a total of 670 insects had been exposed to the h.f. fields and 120 insects were found in the unexposed control blocks. The applied voltages and times of exposure were so varied that the temperature of the wood after treatment varied from 34°C to 82°C.

A detailed analysis of the results is given in the original report and only a summary can be given here. It was found that the temperature of the wood must reach 65°C in a time not less than 40 secs. to ensure 100% mortality of the *Lyctus* larvae in the wood. With shorter exposure times some larvae survived unless the voltage was increased to give a final higher temperature in the wood. Some additional tests confirmed that exposures required to kill larvae were adequate to kill adult beetles. The effect of the treatment on *Lyctus* eggs was not studied, but usually temperatures which kill larvae will destroy eggs.

Tests with Stray Fields

The tests described in the foregoing were extended to a study of the use of so-called stray fields. A stray field is produced when electrodes are placed near to one another on one surface only of the material; the heating produced is a consequence of the fringing effect which, in these conditions, is quite pronounced owing to the much higher permittivity of the wood compared with that of air.

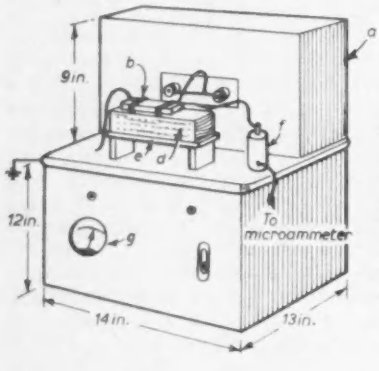


Fig. 2. H.F. test equipment arranged for stray field test

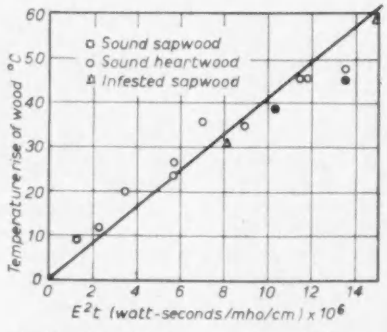


Fig 3. Plot of temperature rise with heating input

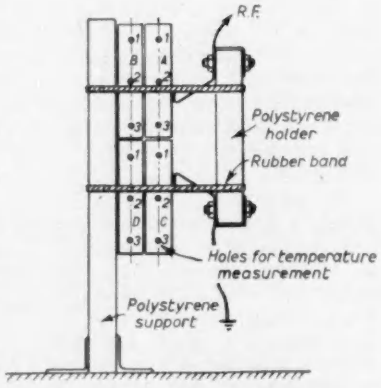


Fig. 4. Test rig to simulate conditions in panelling under stray field h.f. heating

By means of the experimental arrangement shown in Fig. 2 it was found that, in the vertical plane midway between electrodes 3 in. apart, the field strength at a depth of $\frac{1}{8}$ in. was about two-thirds that at the surface and about one-half at a depth of $\frac{1}{4}$ in.

It was therefore to be expected that, with stray field heating, the surface of the wood was likely to get much hotter than the interior; this was confirmed by experiment, but it was also found that the surface layers cooled more quickly. Thus, with the stray field method, it was of benefit to use intermittent heating and cooling to avoid excessively high surface temperatures which might damage the surface finish.

Infested wood blocks were tested in two-layer stacks, making a thickness of 1 in. under the electrodes. The better to simulate panelling, the test blocks were supported vertically and the electrodes held on by rubber bands (Fig. 4).

The results of these tests indicated that a temperature of about 70°C or more in all parts of a 1 in. thick wood panel could be attained, using stray field heating, by three periods of 30-second exposures, with intervals of one minute, with an applied voltage of 3,600 kV (r.m.s.), the electrodes being 3 cm apart. As a further safeguard against excessive surface temperature during the treatment, the use of an air blast can be recommended.

Conclusions

The expectation that the insects could be killed with only a small rise in temperature of the wood because of their higher conductivity, and the consequent differential heating effect, was not borne out by the results obtained. The explanation of this is that differential heating is only possible with exposures so short that there is no time for heat loss by the insects to the host material but, with short exposures, an appreciably higher temperature is required to cause death.

This means that on the basis of energy consumption the h.f. method is not competitive with conventional methods. The relative costs are, however, influenced by other factors and each case must be judged on its merits. It is estimated that, for oak having characteristics similar to that used in the foregoing study, the net h.f. power requirement in kW is numerically equal to about half the volume of wood in cubic feet treated per hour of generator operation; the gross power requirement is about double this figure.

It is suggested that stray-field h.f. heating provides a unique method of sterilising wood panelling *in situ* where the back surface is inaccessible. Moreover, h.f. heating may be a convenient alternative to kiln heating in factories where dimensioned stock has been exposed to infection, since the method could be used without interrupting the normal flow of sawn timber through the kilns for drying. This would apply particularly where a h.f. apparatus was already available for the setting of glue joints.

The author is indebted to Mr M. G. White, M.A., F.R.E.S., entomologist, of the Forest Product Research Laboratory (DSIR) for his co-operation in this investigation. Acknowledgement is also made to the Agricultural Research Council for contributing to the cost of the work and to the Director of the ERA for permission to publish this article.

REFERENCES

1. A. Morris Thomas and M. G. White: "The Sterilization of Insect-infested Wood by High Frequency Heating." "Wood," Vol. 24, 1959: October, pp. 407-10; November, pp. 449-51; December, pp. 487-8.
2. R. F. S. Hearmon and J. N. Burcham: "The Dielectric Properties of Wood," Forest Products Research Special Report, No. 8, HMSO, London, 1954.

Scottish Plans for Energy Supply

PREDICTIONS of energy requirements for Scotland in the period of 1965 to 1970 were the subject of a paper by Messrs J. Henderson (chief engineer, S of S EB) and C. L. C. Allan (chief electrical and mechanical engineer, N of S HEB) presented to the recent Madrid sectional meeting of the World Power Conference. They estimate that by 1970 Scotland will have a total energy requirement of about 27 million tons of coal equivalent, after allowing for probable improvements in thermal efficiency.

In meeting this total energy requirement, they estimate that coal consumption will stay level after 1964 at about 18 million tons a year. Increased requirements for energy will be met by other power sources, and by better efficiency. Development of hydro resources will continue, with capital costs ranging from £125 to £200/kW. Depending on load factor, average cost of generation from such stations would be in the range of 0·65 to 0·86d/unit. Pumped storage on the basis of Loch Awe is estimated to cost £38/kW and to give a cost of energy returned to the system at peak times of 0·3d/unit, assuming nuclear power available for pumping at 0·2d/unit. Running cost at the Hunterston nuclear power station should be about 0·2d/unit.

For the period up to 1966, there are firm plans for adding 1,523 MW of generating capacity; 580 MW as coal-burning, 360 MW nuclear, 400 MW pumped storage, and 183 MW other hydro plant.

Subsequent to 1966, additional generating capacity of between 200 and 300 MW a year will be required in Scotland. An early choice is likely to be a new coal burning plant in the centre of new coalmining developments, either on the east coast of Fife or on the south shore of the Forth estuary, about 15 miles east of Edinburgh. Sets of between 200 and 300 MW would be installed at a cost of about £46/kW. All-in cost per unit generated might be between 0·525 and 0·545d. Success with the Barony slurry burning plant has led to consideration of a further 60 MW plant of this type as well, at a site in Fife. Consideration is also being given to burning slurry along with higher calorific value coal in a large high pressure unit boiler.

Construction of a second nuclear station in Scotland is likely to be deferred until 1969 or 1970, when such stations should be more competitive with coal-based plants. A further station could be accommodated on the Hunterston site, or a site between Aberdeen and Dundee might be appropriate in view of the high transmission costs associated with the growing load on the east coast of Scotland.

Hydro development during the 1966 onwards period is likely to be characterised by design for the lowest load factor acceptable on the system. No more pumped storage capacity is envisaged until more nuclear stations are built. Possible sites for development after 1970 include Loch Lomond, with an enlargement of the existing 130 MW hydro station at Sloy.

Automation in television receiver assembly

MODERNISED PRODUCTION DOUBLES G.E.C. OUTPUT

"AUTOMATION" is a word which is inclined to be over-used these days. If, by the term, one is to assume that practically the whole of a sequence of production processes normally carried out by works personnel is done by machines without human intervention, then automation, as such, is rarely, if ever, to be found in industry. The degree to which automatic processes are incorporated into a production line is a matter of economics; there are a number which could be done by machines if time and expense were not the criteria of efficient production. In fact, manual operation competes successfully with machines in many cases.

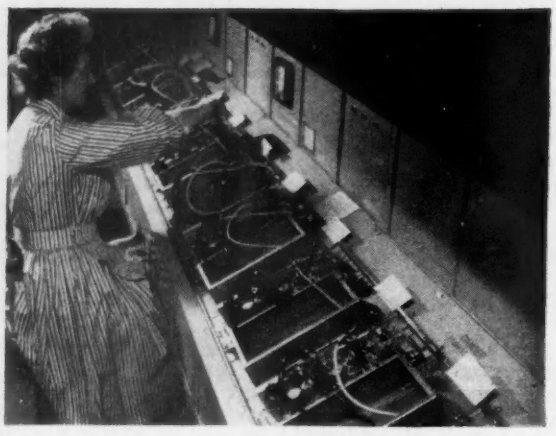
At the Coventry factory where GEC television receivers are made, the recent reorganisation of the production lines has resulted in an increase of output by 100% with a 50% saving in floor space. Many of the processes have been mechanised on the most modern lines in the new layout, but the number of operatives has been increased at the same time on other assembly work so that the overall reduction in direct labour costs per set of the doubled production has been reduced by one-third. The additional space which has been made available by the new arrangement is now allocated to other activities in the expanding GEC radio group—telecommunications, electronics and new development projects—so that the staff has increased overall to above 11,000, making the company the biggest single employer in Coventry.

About 40 different radio and TV models are in current production, including some for export markets, and the lines can be arranged for continuous output of any one or of a number simultaneously. The basis of present-day receiver production is the printed circuit and the method chosen is one using copper-faced phenolic laminate board on which the circuit is applied by photographic methods, the unwanted copper between individual connectors being removed by ferric chloride sprayed over the surface as the panels pass through the machine.

Assembly of the components on to the printed circuit panels is also partly "automated," the panels being continuously conveyed on a belt beneath a number of magazines, each of which automatically inserts a component. Exhaustion of any one magazine stops the belt until it is replenished. At the next stage the partly filled panels are conveyed past operators who insert the larger components, the panel then being transferred to a soldering machine which fluxes the joints and floats the whole assembly on a surface of molten solder where it takes up sufficient to make an efficient soldered joint at each junction. After careful inspection, valves are inserted and the panels pass to the testing machine

In the testing machine every panel is conveyed through a number of stations at each of which a 25-second test is applied. At certain of these stations operatives make adjustments to components requiring presetting. A card attached to each panel records, by a hole punched in a specific area, failure to pass any particular test. Those with a clear record at the end pass to the assembly benches; those with faults pass to other benches where adjustments and, if necessary, replacements are made.

On the assembly lines operatives take a metal chassis framework and attach, first the panels and then other components in successive stages as the chassis passes. The complete sequence takes about 3½ hrs.



General view of one of the two main assembly lines for television receivers at the GEC Coventry works with, on the right, the automatic testing machine which records failures on a punched card

A.C. motors in ships

AVAILABLE TYPES AND THEIR APPLICATION

by J. C. H. Bone,* B.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.

THERE is at the present time a deep and growing interest in the application of alternating current to marine practice. The considerable number of vessels now operating with alternating current supply systems have demonstrated its practicability for service afloat, so that when considering new tonnage progressive engineers are increasingly considering alternating current systems as alternatives to conventional direct current systems.

Other articles in this series explain the advantages of alternating current in relation to power generation and distribution; in many instances these advantages alone would justify the use of alternating current. There are, however, many additional advantages in the field of utilisation, particularly for drives where the squirrel cage induction motor can be used, whose rugged simplicity contrasts, at any rate at first sight, with conventional d.c. motors. The significance of the contrast should not be exaggerated, however, in view of the astonishingly reliable performance which is habitually obtained from d.c. machines.

Engineers dealing with d.c. machines soon appreciate that the vast majority of such machines belong to one closely related family. This will not be found to be true for a.c. machines, which fall into several distinct classes, some of which bear a family likeness to d.c. machines, although most are very different. This implies that whereas the d.c. machine has to be something of a "Jack of all trades," the a.c. machine tends to be a much more specialised equipment. This is, of course, not necessarily bad (specialisation is one of the signs of civilisation), but this does mean that to utilise the advantages of alternating current to the full it is essential to be clear as to exactly what characteristics and performance are required from the motor. It is fatally easy to dissipate needlessly these advantages by inaccurate or slipshod specification.

Squirrel Cage Induction Motor

The most widely used of all a.c. motors is the squirrel cage induction motor, a tough, rugged machine which, by the skill and ingenuity of the engineer, can be designed to carry out a wide variety of duties. Basically the machine consists of a slotted stator containing a distributed polyphase winding which is energised from the supply, and which, in addition to carrying the load current, also carries the magnetising current of the motor. The rotor winding consists of a set of uninsulated bars (normally of copper or aluminium) short-circuited at each end by end rings. The construction of the machine is, therefore, simple, cheap and robust.

When such a machine is started by being connected directly to the supply it will take about six times its full-load current, which at first sight may appear high. This current needs, however, to be compared with currents taken by other machines started in a similar way. For instance, a d.c. motor connected directly to the supply would take fifteen or twenty times its full-load current (hence the almost universal use of resistance or reduced voltage starting for d.c. motors). The robust construction of the induction motor is such that it can readily withstand its own direct-on starting current.

A study of the torque/speed and current/speed characteristics of the squirrel cage motor yields a good deal of useful information about the motor. It will be seen from Fig. 1 that the speed of the motor varies little with torque between its no-load (or synchronous) speed and the "pull out" point where the torque reaches its maximum value (of the order of 200% to 250% of full load). Beyond this point the torque falls away (although the current continues to rise), until at standstill the starting torque will be of the order of full-load torque (at which point the current will have risen to its maximum of about six times full-load current). The precise values of starting current, starting torque and peak torque vary from machine to machine, depending upon, among other things, the size and speed of the motor. Alterations to either the resistance or the reactance of the rotor alter the characteristics, although in general it can be said that an improvement of any one feature is normally only possible at the expense of others. For instance, an increase in the resistance will improve the starting performance, but only at the expense of unacceptable losses in the rotor at full speed, i.e., values which give optimum starting characteristics unfortunately differ appreciably from those which are acceptable for the running condition.

An automatic fall in resistance with speed is achieved by exploiting the so-called "deep bar" effect. The reactance of a rotor conductor increases with its distance from the rotor periphery so that at start, where the rotor frequency

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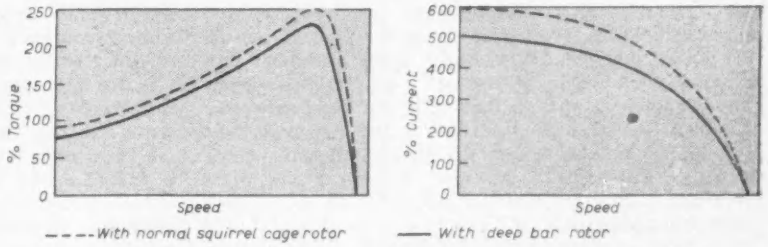


Fig. 1. Typical squirrel cage induction motor characteristics

Fig. 2. Typical torque/speed curves of double cage induction motor : contribution of individual cages
Fig. 3. Comparison of characteristic curves for high starting torque double cage motor (full lines) with conventional squirrel cage motor (dotted lines)
Fig. 4. Comparison of characteristic curves of low starting current double cage induction motor (full lines) with conventional squirrel cage motor (dotted lines)

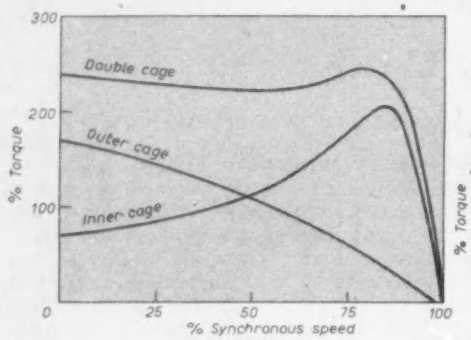


Fig. 2

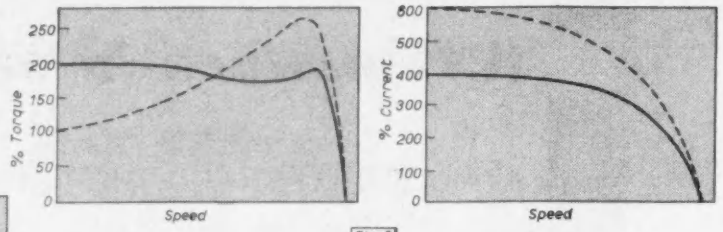


Fig. 3

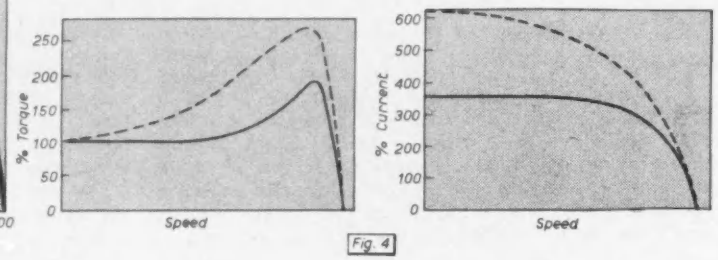


Fig. 4

is at its maximum, the current in these bars is not uniformly distributed over the conductor but tends to concentrate in the low impedance parts, i.e., in those parts of the conductor closest to the bore. The conductor, therefore, behaves as if its cross section had been reduced and its resistance thereby increased. As the motor gathers speed the frequency in the rotor falls off until at normal operating speeds it is usually less than one cycle per second. At such frequencies the reactance of the bar has a negligible effect on its impedance and, as a consequence, the current now distributes itself uniformly across the whole cross section of the bar, whose resistance now approximates to its normal value. Machines designed to utilise this effect have an improved starting performance compared with normal squirrel cage machines.

This effect can be made more pronounced by the use of specially shaped bars which are designed to concentrate a large portion of the bar deep in the slots. To obtain the maximum benefit from this so-called "current displacement" effect, separate conductors having different impedances, i.e., located at different depths in the rotor, are used. With this construction it is possible substantially to divorce the starting performance of the machine from its running performance; the inner cage carries hardly any current at start and only contributes substantially to the torque when the machine is almost up to speed. On the other hand, the outer cage, which has a high resistance but low reactance, develops most of the starting torque but contributes little when the machine is up to speed. The resultant torque/speed curve of such a machine is the sum of the individual curves of the two cages (Fig. 2). A wide variety of starting characteristics can be obtained with such a construction, ranging from a "high torque" machine which develops twice full-load torque at start with about four times full-load current (Fig. 3), to a "low current" motor which develops just over full-load torque with about three-and-a-half times full-load current (Fig. 4). Further refinements in the design of double cage machines are possible, for instance, the "Trislot" design has an inner cage which is itself split into two layers (Fig. 5) which, in addition to assisting the design of the magnetic circuit, also permits the use of a pitched running winding which avoids the secondary, but nevertheless often important, influences of higher harmonics on the torque/speed characteristic.

The heat developed within the rotor of a squirrel cage motor while it is accelerating is equal to the kinetic energy stored in the rotating system when it is up to speed. As the run-up period is relatively short, little of this heat can be dissipated and the rotor windings must, therefore, have sufficient thermal capacity to absorb, temporarily, this heat. This often necessitates the use of high resistance materials, particularly for the starting windings of double cage machines, in order to obtain a larger volume of material than would be the case if normal copper bars were used.

Instead of a squirrel cage rotor the induction motor can be designed with a wound rotor (similar in appearance to that on a d.c. armature except that instead of being connected to a commutator the winding is connected to three slip-rings). The use of a wound rotor permits the insertion of additional external resistances into the rotor circuit so that a good starting performance can be easily obtained, i.e., a high starting torque with a low starting current. The resistances are cut out in steps as the machine runs up to speed, where it runs with its slip-rings short-circuited, with a performance almost as good as that of a squirrel cage machine.

Choice of Speed

It has already been noted that the induction motor is essentially a fixed-speed machine. Its operating speed is little affected by load, supply voltage or operating temperature. The choice of operating speed is, however, limited to speeds just below a series of "synchronous speeds." These synchronous speeds depend on the number of poles for which the machine is wound and the frequency of the supply. For a 60 c/s supply, the available speeds for 2, 4, 6, 8, 10, poles are 3,600, 1,800, 1,200, 900, 720, r.p.m. It is unrealistic to specify speeds which differ appreciably from synchronous speeds as they cannot be economically obtained from normal induction motors without considerable sacrifice in both the simplicity and efficiency of the equipment.

If two discreet operating speeds are required, the squirrel cage motor may be wound with two separate and distinct stator windings, one for, say, six poles and the other for, say, eight poles. Depending on which of the two windings is energised, the motor will run at one or other of the corresponding synchronous speeds. In the special case where the required speeds are in the ratio of 2: 1, it is possible to design a simple single winding which is capable of simple reconnection to double the number of poles.

The ability to change the resistance of the rotor circuit by using a wound rotor with slip-rings instead of a squirrel cage rotor has already been mentioned in connection with improvement of starting performance. Such external resistances can also be used to vary the speed of the motor (Fig. 6). Wide speed variations against constant torque loads are, however, not normally regarded as economical by this method because of the large amounts of power which have to be dissipated in the resistance at low speeds; for instance, in order to halve the speed of a 100 h.p. motor it is necessary to dissipate 50 h.p. in the resistances to obtain the constant torque output of 50 h.p. at the shaft, i.e., the "ideal" efficiency of such a scheme cannot exceed 50% (for lower speeds the position is even worse, for instance, at one-fifth of the synchronous speed the ideal efficiency falls to 20%). For small speed variations with falling torque drives (for instance, fans or pumps), the method can be justified occasionally either in this form or, alternatively, using the equivalent mechanical system which consists of a constant speed squirrel cage motor driving through a slip coupling (either of the magnetic or hydraulic type). The function of these slip couplings is to replace the resistance of the slip-ring machine and they have, therefore, substantially the same (although in practice a somewhat inferior) performance; the losses being dissipated within the coupling instead of in the resistance. The speed of slip-ring machines is very dependent on load, particularly if wide speed ranges are required. In addition, the speed control becomes difficult as the load is reduced (the speed always returns to the maximum speed when load is removed). The output speeds of slip couplings also behave in a similar manner.

Variable Speed Motors

When a true variable-speed a.c. motor is required, then it is necessary to use an a.c. commutator motor of which there are two main types, the rotor-fed or Schrage motor, which has moving brushgear, and the stator-fed type, which has fixed brushgear and uses an induction regulator for speed control. In contrast to the slip-ring motors, in these machines the energy which would have been dissipated in resistances is now fed back to the supply so that a fundamental improvement is achieved in the efficiency of the equipment. The basic difficulty in feeding back this energy is associated with the fact that at the slip-rings of an induction motor the power is at a frequency and voltage which varies with the speed. It is, therefore, necessary to use some form of frequency conversion and voltage regulation to convert this power into a form suitable for feeding back into the constant frequency constant voltage supply. This is achieved in the stator-fed machine (which is the more easily understood of the two types of variable speed motor) by replacing the slip-rings with a commutator which automatically changes the rotor frequency within the machine to supply frequency at the brushes. The variable voltage which appears at the commutator is converted to the supply voltage by means of a variable voltage transformer which may take many forms but which is commonly an induction regulator. The energy balance of such a scheme is compared with that of a slip-ring machine in Fig. 7. It will be noted that the commutator motor is capable of running above synchronous speed as well as below synchronous speed, a valuable feature which is not available with the induction motor.

For the sake of completeness reference must be made to the synchronous motor which is, in effect, an alternator

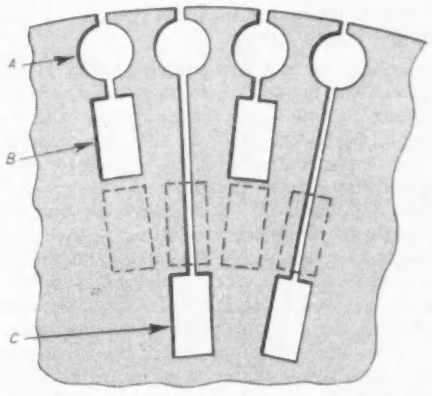


Fig. 5. Typical slotting for a "Trislot" motor. A is slotting for starting cage, B and C for running cages. A similar performance could be obtained from the dotted running cage shown; the path available for the magnetic flux which must pass between the slots is then, however, much more restricted

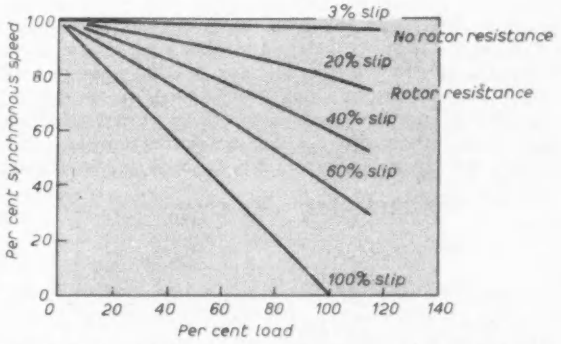


Fig. 6. Use of external rotor resistance to control speed of a slip-ring induction motor

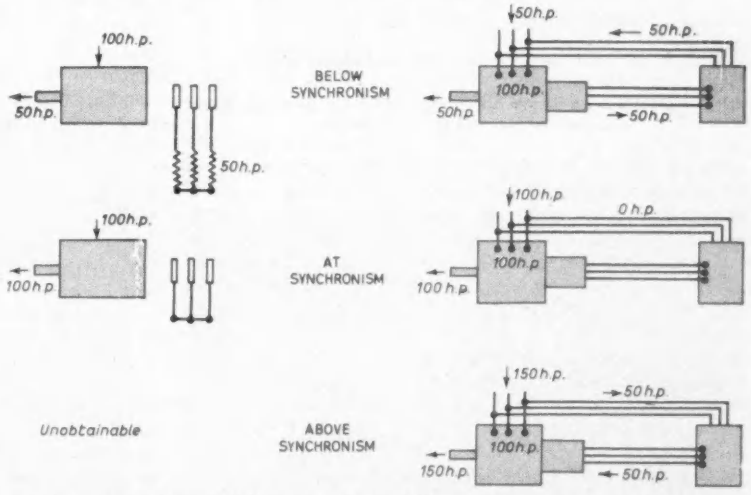


Fig. 7. Comparison of energy balance for slip-ring (left) and a.c. commutator (right) motors. In the latter, losses are avoided by returning the slip power to the supply, and running above synchronous speed is possible

whose excitation is adjusted so as to make it operate as a motor. The limitations of the machine are, however, such that it is unlikely to find application on board ship.

Considerations Governing the Choice of Motors

Having briefly considered the characteristics of the more important types of a.c. motor it is possible to discuss the considerations which influence the choice of motor for the various marine drives.

The capacity of a ship's supply system is inherently small in relation to the largest motors connected thereto. The starting current of the larger motors will, therefore, represent a significant load on the alternator and will result in a corresponding reduction in voltage. Alternators, even in their more sophisticated forms, have greater voltage regulation than their d.c. counterparts so that it is easy to appreciate the importance of reducing the motor starting currents to values within the capacity of the alternator and its control gear to handle without excessive voltage depression. It would be foolish, except in exceptional circumstances, to discard lightly the advantages of the simple "direct-on" induction motor starter in favour of more elaborate forms simply in order to relieve the alternator loading. Whilst there will be occasions where this course may be justified, proper co-ordination between alternator and motor design enables the simple direct-on induction motor starter to be used for the vast majority of drives. The substitution of slip-ring motors for squirrel cage motors so as to reduce starting currents is seldom sound practice. The additional cost of motor and starter could very often be better spent on a larger or more elaborate alternator installation; for instance, compounded alternators can be very successfully used in conjunction with double cage induction motors. The current taken by slip-ring motors during the starting period is in any case seldom as low as is commonly believed unless several

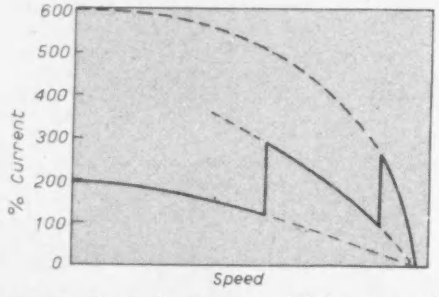


Fig. 8. Currents taken by slip-ring motor while being started by means of a three-step rotor resistance starter

steps of starting resistance are used (Fig. 8), resulting in an expensive starter. Where only a low starting torque is required (for instance, fans and pump drives) star-delta starting is occasionally suggested. If a motor designed to run with its windings connected in delta is temporarily connected in star, the volts per phase are reduced in the ratio of $\sqrt{3}$: 1. If the machine is, therefore, started in star connection this is equivalent to reducing the voltage on the machine to about two-thirds of the normal value, and hence the starting current (and torque) is reduced to one-third of the normal direct-on value. These advantages are to a certain extent illusory, due to the fact that when the machine is almost up to speed the windings require reconnection from star to delta; the currents which flow whilst reconnection is taking place are generally greater than the initial starting currents. As the motor retains some magnetic flux whilst the supply is being reconnected, heavy transient currents may flow whilst the motor re-establishes its new flux (similar conditions apply with autotransformer starters used to obtain reduced voltage starting). Methods of reconnection are available which do not involve interrupting the supply to the motor during the starting period (the Wauchope connection for star-delta and the Korndorffer connection for autotransformer), but the additional complexity of these systems does, of course, increase the cost of the starters.

It is often desirable to control the output of a centrifugal pump. This may be achieved by driving the pump by means of a constant speed induction motor and varying its output by the control of a throttle valve (the cheapest but least efficient method). Alternatively, a variable-speed drive may be adopted, using slip-ring motors or slip couplings (more expensive and more efficient than throttling) or a variable-speed commutator motor may be used (more expensive still but most efficient).

Similar alternatives are available for the drive of boiler fans, although the choice of drive is even wider; two-speed induction motors with vane-controlled fans, and a.c. commutator motors designed to have series (rather than the more common shunt) characteristics being two of the additional alternatives available. In this context it must be remembered that the type of transient current which flows when two-speed motors change speed is similar to that mentioned in connection with the similar problem of star-delta starting, and precautions may need to be taken to ensure that the change-over is accomplished under as favourable conditions as it is possible to obtain, particularly in switching from high to low speed.

To obtain the most economical overall solution, it is necessary to calculate the "capitalised value of the losses," i.e., to calculate how much extra capital it is worthwhile spending initially on a more expensive but more efficient solution in order to reduce the losses by, say, one kilowatt over the expected life of the equipment. The true economic comparison between the various schemes must, therefore, be based on the sum of the initial capital cost, including starting and control gear, plus the capitalised value of the losses.

Conclusion

It is hoped that this article will have indicated both the advantages and the limitations of the more common types of a.c. motor, together with an indication of the factors which influence the proper design of a marine a.c. installation. It will be clear from the article that the induction motor (in one form or another) is capable of satisfactorily handling the vast majority of drives encountered in marine practice. Nevertheless, no advantage is to be gained by coercing the squirrel cage induction motor on to drives for which it is inherently unsuited. There is no incentive for this course of action as there are other more suitable motors available capable of developing exactly the characteristics required by these special drives. It is often suggested that a.c. motors are less versatile than their d.c. counterparts and that as a consequence a.c. motors with special characteristics cannot be easily obtained. This criticism is generally coupled with a reluctance to accept commutators on a.c. machines on the grounds that "all commutators are undesirable." The widespread and very successful use of commutators on d.c. machines for many years effectively demonstrates that there can be no valid objection to the use of properly designed and manufactured commutator motors for the few occasions where the special requirements of the drive indicate the necessity for characteristics which cannot easily be obtained from induction motors.

International medical electronics

THIRD CONFERENCE AND EXHIBITION AT OLYMPIA

ALTHOUGH the conference on medical electronics which has just terminated at Olympia is designated as the third, it is in reality only the second occasion on which such an assembly dedicated to the study of the application of electronics to medical research and practice has been held. In 1958, Dr Vladmir K. Zworykin, who is probably best known for his work on the development of the iconoscope, which made television as we know it today possible, and also the electron microscope, was attending a congress in Paris which was largely concerned with colour television when he casually mentioned the work which was in progress in the USA on medical electronics, a subject in which he was becoming more and more involved. In fact he had been invited to form an electronics laboratory devoted to this aspect of research at the Rockefeller Institute.

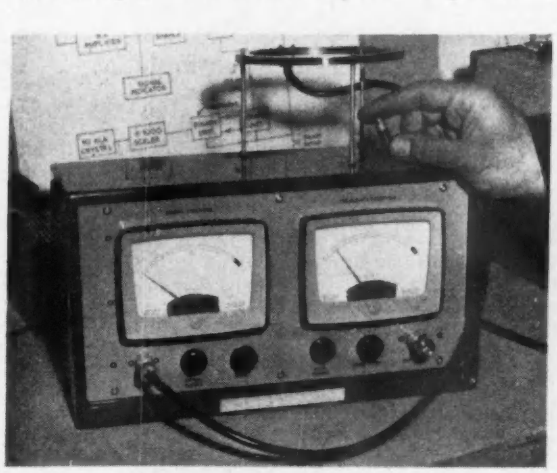
The tremendous interest which was shown prompted Dr Zworykin to organise a preliminary, somewhat informal conference in Paris that year to discuss international participation and more than 50 scientists from 12 countries attended. As a result a second conference was arranged for 1959 at the new UNESCO headquarters in Paris at which an exhibition of equipment was included. More than 400 participants from 17 countries attended, a large number of papers were read and the International Federation of Medical Electronics came into being officially with the adoption of Articles of Federation on June 24 and the election of Dr Zworykin as the first president. On this occasion an invitation to hold the third conference in Great Britain, extended by the IEE, was gratefully accepted and on Thursday last, 21 July, Sir Willis Jackson, president of the IEE, supported by Dr Zworykin, officially opened the conference and exhibition. At the Press conference which preceded the opening, Sir Willis Jackson said that some 630 delegates from 22 countries had already arrived and it was quite possible that the final figure would be close on 800 as acceptances were still coming in. He paid tribute to the organising committee under the chairmanship of Dr R. C. G. Williams and the two panels which had been responsible for arranging both the programmes and the exhibitions.

Opening Address

In his speech replying to Sir Willis Jackson's welcome, Dr Zworykin referred to the work which was already under way as a result of the previous year's conference. A bibliography on medical electronics had already passed its third issue and plans were being discussed for a new journal devoted to the subject in which reports of original work from all countries and news of the organisation would appear. It was also possible that the Federation might act as a clearing house for ideas and problems arising in the field of application and might even lead to the formation of an international Medical Electronics Research Institute to act as a testing ground for ideas and devices and bringing them to a state of clinical evaluation. We had already succeeded in establishing a co-operative group with a common viewpoint despite differences of nationality, outlook and language and this would be promoted further by the fourth conference to be held at the UNO headquarters in New York next year, if present arrangements hold, and, it was hoped, in a succeeding year in the USSR.

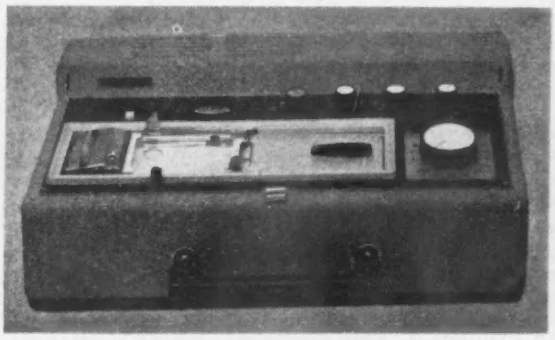
Conference Reports

The extensive programme of lectures and discussions covered more than 130 papers and was held in two conference halls in a series of sessions each devoted to one aspect of the wide field of medical electronics. In some the purely medical aspect of application and research by



Left: The Solartron endoradiosonde or "tumnik" with the associated receiver. The tiny pill incorporates a transistorised radio transmitter working at 450 kc/sec, a battery and a transducer which transmits signals to the receiver shown

Below: Typical of the overseas equipment shown at the exhibition is this compact transistorised electrocardiograph weighing only 24 lb with all accessories and made by Fukuda Electro of Japan



and with the use of electrical appliances was the keynote, with doctors and surgeons the main participants; in others, electrical design and application was the chief subject.

The first of the papers, by Professor J. McMichael, F.R.S., covered a brief historical survey of the interchange of interests between the medical, or biological, professions and the scientific world of the physicist and electrical engineer over the ages.

Dr Zworykin, taking as his theme "prospects in medical electronics," examined some of the major recent trends in electronics and endeavoured to use them as a basis for forecasting possible future uses in the biological field. Certainly the most significant step has been in the miniaturisation of equipment made possible by recent inventions of the transistor, crystal diodes, thermistor, photoelement crystal devices, miniature magnetic core and transfluxor and the tunnel diode. These had made possible the design of small transmitters or "endoradiosondes" which could be inserted or passed through the body to sense local conditions and transmit the information to a receiver located near to the patient. At present these small devices depended on the internal battery for their life-length of operation but it was possible that they might, in future, obtain it from external inductive sources so removing the time limitation, at present about 72 hours.

Using the hospital paging device to locate doctors as the starting point of his next concept for the future, he envisaged health records of all patients being recorded electronically at a giant central point, an *Index Medicus*, which could be consulted by physicians and surgeons whenever necessary either by radio or telephone and the benefit of comparison between the current and the standardised health record being made available in a form which could form an important element in preventive medicine. It would also form the basis of a computer technique in diagnosis and he instanced a tentative beginning to such methods in recent work in the field of hematologic and ophthalmic diseases.

Electronic Health Library

In discussion he enlarged on this concept, pointing out that a thousand inches of ½ in. tape occupied a very small space but one could, on ten inches of tape, record the history of one patient. At 100 patients per spool and with the spools mounted in circular layers on rotating cylinders, it did not take much calculation to see that many millions of such records could be stored in a central library of not excessive dimensions and that selection of any one record was only an extension of modern electronic computer memory techniques. As to access, he suggested that radio channels would be the best possible form. A large proportion of present-day transmitting time was unused and could be impressed for such a purpose. Alternatively, many of the channels in short-wave bands were unused and could be allocated for such duties. Though only a distant concept, he did not think that it was an impossible one; it was less fantastic than many of the devices which we have come to regard as everyday must have seemed only a very few years ago.

Mr H. S. Wolff, describing the responsibilities of the medical research worker in laboratories and universities, said that too many thought their work was done when they presented the results in a paper or publication. They had an additional responsibility; to bring it to the notice of industry in a form which could be manufactured so that hospitals and doctors could have the equipment in a complete form. Laboratory hook-ups were all very well for research but they are of little use in everyday application.

He listed five criteria for successful development of laboratory ideas. First, the laboratory must be close to a manufacturer of such equipment; second, the latter must be small enough to enable direct access to the management to be possible; third, it must have experience and facilities for suitable manufacturing techniques; fourth, the research worker must have the ability to generate faith in his appliance and in the manufacturer; and finally, in fairness to the laboratory and his associates, he must see that the agreement for producing the appliance or equipment includes some financial return. This means that he will have to spend some additional time in development work but he would have to look upon this as a sort of dowry for his brain-child. He would certainly have to exercise patience with draughtsmen who, from his experience, had a habit of dishing up designs which had been discarded for various reasons in the development stage.

In the numerous papers there were many other features of great interest to the electronics and electrical engineer and it is to be hoped that the full list of papers and discussions will be made available rather more rapidly than has been possible on previous occasions.

The Exhibition

The exhibition of electronic appliances was compact and varied but vastly interesting to visitors to the conference. Sixty-four stands were occupied by manufacturers from Britain, France, Denmark, USA, Japan, Sweden, Germany and Italy. In addition, there was an exhibition of the work being carried out in the hospital research centres and universities.

One of the most interesting was the miniature endoradiosondes which are now being made by Solartron Electronic in conjunction with the universities for the measurement of temperature and pressure as it passes through the body, transmitting the values as variations of transmission frequency to a receiver by the side of the patient by radio. The "pill," which is swallowed by the patient, comprises a small, smooth cylinder 25 mm long by 9 mm dia, containing a mercury battery, a transmitter working at 450 kc and a transducer for converting the pressure of temperature into variations in frequency. It has been accorded the colloquial name of "tumnik" but will have commercial as well as medical applications. It was also described in the paper on clinical telemetering techniques by Dr Nöller.

Equipment from overseas manufacturers was also of an exceptionally high standard both as regards performance, presentation and finish. The portable cardiographs from Japan are exceedingly compact and beautifully engineered and, a small but significant point, the controls were all identified by English descriptions whereas Italian and German appliances retained their own language for the purpose. Colour television was shown on the Sierex stand where it was set up for viewing an operation, the "patient" on this occasion being a piece of steak which showed up realistically on the screen.

Another exhibit of considerable interest was the heart and lung machine which takes over the functions of these two human organs while they are cut out of the blood-stream circuit for surgical work. This has received a considerable amount of publicity in the Press in recent months and this was an opportunity of seeing the machine at close quarters. Even the homely stethoscope has now been replaced by electronic versions which are able to differentiate between the heart and the breath sounds. A number of home and overseas companies were showing these devices some of which could be coupled to recorders to give visual as well as audible indication.

Finally there was a fascinating variant of modern t.v. technique which "froze" a single frame on to a storage tube to provide an instantaneous still picture.

CIGRE 1960

Protection and Relaying

The 1960 CIGRE discussion on relaying and protection clearly revealed the growing importance attached to the application of semiconductor techniques to protection. It was also evident, however, that most speakers were not yet confident of applying these devices in practice until they have been thoroughly proved on test or in pilot schemes.

Protection and Relaying

CONSIDERABLE interest at this session was shown in the proposals for using semiconductor devices in relaying and protection equipment. MR MARCHAL (Belgium) referred to a phase comparison transistor device installed on the Belgian power system, designed to give operation of an auxiliary relay within one cycle of the occurrence of a phase displacement between transistorised relays, due to a fault, greater than 20°.

A Russian paper outlining proposals for carrier current, distance and differential protection was referred to by MR FEDOSEEV (USSR). Several speakers, including MR ADAMSON (GB), mentioned the obvious advantages of the transistorised relay, in view of its small size and low power requirements. These relays, in addition to permitting reduced size of voltage transformers, might well allow air-cored current transformers to be used, with consequent improved accuracy and elimination of errors and corrections necessary for iron saturation.

Several countries were using transistorised relays for distance protection with encouraging results, but the general feeling of the meeting was that before absolute security of function has been proved it would be unwise to use them exclusively for system protection. In particular, more knowledge was needed concerning the behaviour and protection of these relays under surge voltage conditions.

Voltage and Current Transformers

Two valuable papers for the instrument transformer designer were presented at this year's session, one dealing with capacitive voltage transformers and the other with behaviour of current transformers under transient, asymmetric current conditions.

Capacitive voltage transformer design was now well understood and, provided they complied with specified tests under steady state and transient conditions, there was little trouble to be anticipated in their use. MR GERTSCH (Switzerland) thought, however, that in spite of good results obtained, a deeper understanding was required of problems of ferro-resonance and he suggested this as a future field of study for the relay and protection group.

Current transformers have been shown to be severely affected by initial transient current conditions with resultant maloperation of relays. MR HODGKISS (GB) said that provided suitable precautions were taken, notably the provision of stabilising resistors, good results could be obtained while still maintaining high operating protection speeds.

Extremely good operation performance of gas detectors fitted to transformers was detailed in a Canadian report which provoked a profitable discussion at this year's session.

Over 42,000 MVA of transformer capacity has been equipped with gas detection relays in Canada and it was concluded in the report that all types of suddenly occurring electrical faults would be detected by the gas detector type of relay, provided certain precautions were taken in their mounting and design. Cases were on record of this type of relay operating when differential protection relays failed to operate. A particularly valuable function was the detection of incipient faults such as joint deterioration in windings, or earthed core bolts, and here again good experience has been obtained, although it was considered essential to lead all gas directly to the relay to avoid any entrapment. Consequently, bushing stacks were piped directly to the relay.

Buchholz Relay Operation

The discussion showed a general feeling that some faulty operation still occurred with the gas detector relay, though too pessimistic a view of their performance was likely to be obtained from statistical results.

MR RATCLIFFE (GB) said maloperation was particularly caused by vibration of the mercury switches and research had shown that vibration of mercury beads in the switches at 100 c/s tended to reduce insulation between electrodes considerably. While this may not, of itself, cause faults, additional vibration produced by a through fault on the transformer may well cause the relay to operate.

He thought more rigorous testing was called for and suggested that switches should not make contact if vibrated over a frequency range up to 300 c/s with an amplitude of 0·5 mm.

Maloperation under earthquake conditions was mentioned by MR GANTES (Chile), and MR BALERIAUX (Belgium) looked forward to the introduction of transistorised relays, omitting the mercury switch.

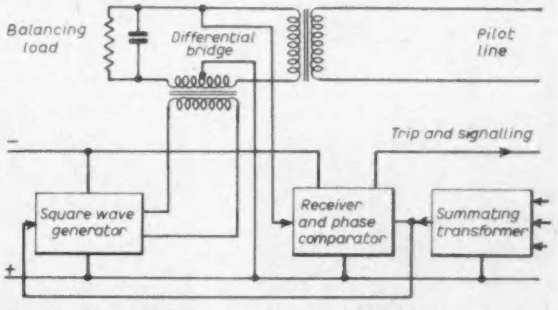


Diagram of transistorised phase comparator protection system now undergoing field trials in Belgium. A phase displacement greater than 20° operates the relay in less than 1 cycle

MR KAUFFMANN (GB) also said he would like to see the mercury switch superseded. The Buchholz relay was very sound and although differential and tank protection were also used, he would not consider the omission of the gas detector relay.

A mercury switch relay of unusual design was described by MR A:GNER (Germany) who claimed that this type was less sensitive to vibration than other types.

Summing up, MR NORMAND (Belgium) said that relatively few troubles were experienced with gas detector relays. Those that did occur were largely due to shifting of the oil level and vibration. There was a need for a more stable element than the mercury switch.

Power Station Auxiliaries

It was generally agreed, during a short discussion on papers dealing with power station ancillary equipment, that in view of the comparatively small number of breakdowns in these services, circuit simplification was justified.

Thermal protection of power station auxiliary motor needed further investigation, particularly with regard to possible use of thermal images. Information is available on this technique and it remains to be exploited.

A comprehensive power station protection system which has been installed in some stations of the Consolidated Edison Company, New York, was described in a report submitted by Messrs BAUMAN, BEATTIE, DRISCOLL, ONDEDONK AND WEBB. (US).

The system, which has been in service since 1953, protects against all major breakdowns in any stage between fuel supply and high voltage busbars.

The system covered the four main sources of breakdown, from the fuel source and boiler through the turbines arrangements. It was in use on five 180 to 335 MW sets.

The boilers were arranged for burning oil, natural gas and coal. Sensitive relays detected failure of flow in any of these fuels and if all the fuel supply to the boiler was interrupted the set was tripped. Tripping was also effected if furnace or flue gas pressure rose abnormally, if there was loss of combustion air by all the fan contactors tripping, or if boiler water drum level fell outside selected limits.

In addition to relays for detecting overspeed, vacuum and oil pressure, the turbines were protected by a recently developed differential pressure relay which detected thrust bearing failure. In this relay, metered jets of oil were directed against the side of the bearing rotating collar, their pressure being controlled by the air gap between the jet and the collar. In the event of a bearing failure change in this pressure differential would actuate the differential relay.

Relays also detected excessive movement due to vibration of the turbine h.p. and l.p. shafts and the generator rotor.

Great reliability has been shown by the scheme and reduction of operational staff has been possible. The system is said to operate under faults conditions which may not be immediately recognisable, even to an experienced operator.

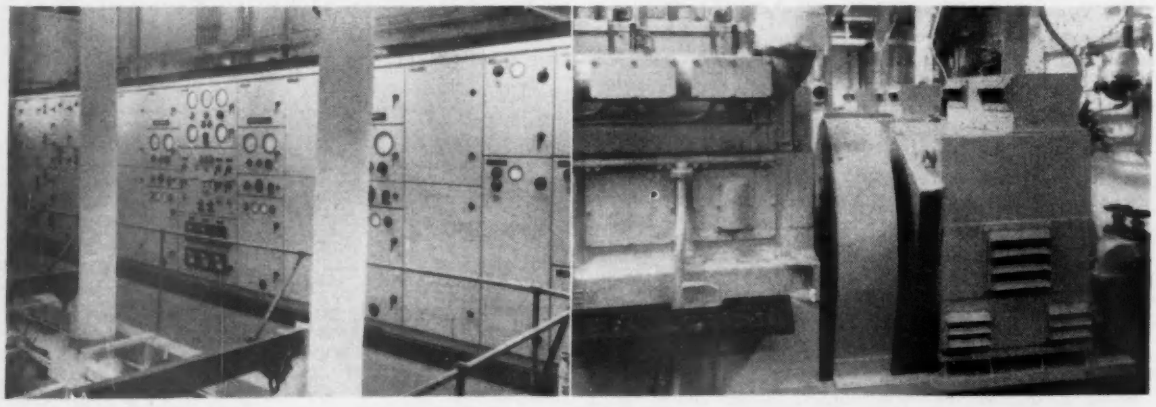
The session concluded with a discussion on the functioning of distance and back-up protection and theoretical problems concerning protective devices.

660 kW Auxiliaries for Ore-carrier

THE first of two 16,500 d.w.t. ore-carriers to be completed by Wm. Gray and Co. for Houlder Bros. and Co., the *Mabel Warwick*, is a motor vessel with all auxiliaries electrically driven from three 220 kW, 275 kVA, 440 V, three-phase, 60 cycle Accurex-controlled self-excited GEC alternators coupled to Crossley diesel engines. Excitation and voltage regulation is static, the excitation current for the alternator main field being derived from the a.c. output through air-cooled rectifiers mounted in the alternator cooling airstream, voltage regulation being by magnetic amplifier regulator maintaining voltage to within $\pm 1\frac{1}{2}\%$.

The 36 ft 6 in. main switchboard incorporates a supply section, controlling the alternators, and distribution and group starting sections, the latter dealing with the starting and regulating of 16 s.c. motors, ranging from $12\frac{1}{2}$ to 70 h.p., arranged for direct-on-line starting. A further 17 motors, from $1\frac{1}{2}$ to 20 h.p., have individual bulkhead mounted starters. The distribution section of the board supplies both fluorescent and filament lighting through single-phase transformers at 240 V and supply for the all-electric galley equipment. This comprises a double oven unit range with six 8 in. by 12 in. hotplates above each oven, double deck baking oven, hot-cupboards, water boilers and toaster grilles. Fluorescent lighting has been extensively used in the engine room, saloon, alleyways and crew accommodation.

All of the electrical equipment, alternators, motors and switchboards, also a sub-board supplying hatch cover winches and aft capstans, are of GEC design and manufacture.



Views of the GEC main switchboard and alternators on the "Mabel Warwick"

NOTES ON WIRING

BY MEGOHM

I SUPPOSE it is a little early to think of the winter but recently I have been bombarded with leaflets about electric fires and convectors, etc. Among these leaflets was one giving details of a new floor-heating arrangement which seems novel but will add to the work of the contractor and the planner. I have on occasions mentioned the possible effect of floor-heating systems on the other wiring in the structure and still feel that we have rather pushed this problem aside and won't have anything to do with it until something begins to show. I am not an authority on floor-heating and I think we are all, as yet, rather feeling our way in this medium.

However, to get to this new (to me) method of warming. The heating cables are actually fitted into wood flooring of the tongued and grooved type, and lie in the groove of the board held lightly in position by the tongue of the next board. The boards are securely nailed into position. It is claimed that this system can be installed in solid or suspended joisted floors either on ground floor level or on other levels. The floors can be of either polished hardwoods giving low movement value or selected softwoods to receive carpets, etc. It is claimed that the system can be installed in existing buildings.

That is a general idea of the system and I am, at the moment, only interested in the effects on the other electrical systems or on the maintenance of these. It appears to me that once this type of heating system is installed we can forget any possibilities of getting under the floors again. It may be possible to leave certain traps but I doubt if they could be positioned to allow access to the normal lighting and power installations. I have in mind the possibility of the system being installed in an existing building, which is one of the claims made by the manufacturer and presumably the most likely field of application. The client might well be faced with quite an extensive alteration to the lighting and power installations to ensure a rewire in the future. With new buildings it would be easier but care would have to be taken to ensure that the general wiring was arranged to allow such things as rewiring, alterations and/or additions.

Before the site electrician starts to worry about having to wire such a system, I would like to point out that the manufacturer does all the work from the initial planning stage to the actual laying of the floor and installation of the cable. I still feel, however, that the site electrician will not be without his headaches where and when he meets the system.

Aluminium

Aluminium appears to be coming more into the picture every day. Its presence in the electrical industry has been recognised for a long time now but it has been suggested that, due to political events in other countries, aluminium will become even better known to us. The lack of stability in the price of copper and its sensitivity to events in overseas countries is probably the main possible reason.

One reader has expressed the view that manufacturers of electrical equipment should provide larger terminals on their goods so that aluminium conductors can be readily accommodated. This appears to be sound reasoning if, in fact, we are going to become aluminium-minded. There are, however, many engineers who are not so, and it would take a lot to change their minds. Personally I have not had a great deal of experience with aluminium conductors but well remember the pained expression on the face of a site operative who was installing aluminium-sheathed cables when they first appeared. He had managed to get a large "kink" in the sheathing due to vigorous handling of the cable after being used to the more conventional type.

Switchplates

In my notes in the 14 July issue I mentioned a certain type of plate which I called "damaskeen steel." I find that although the meaning of the word "damaskeen" describes the plate exactly, the manufacturer lists the plate as "damastine." I apologise for the error and any inconvenience caused although I hope my readers may forgive my mistake for both words sound very much the same. I also understand that these plates have proved useful in other buildings besides the hospital mentioned by me. One contractor informed me that he had had a quantity of these plates on a site which was shut down for certain reasons for a period of over two years, yet the plates were as good as new when work restarted.

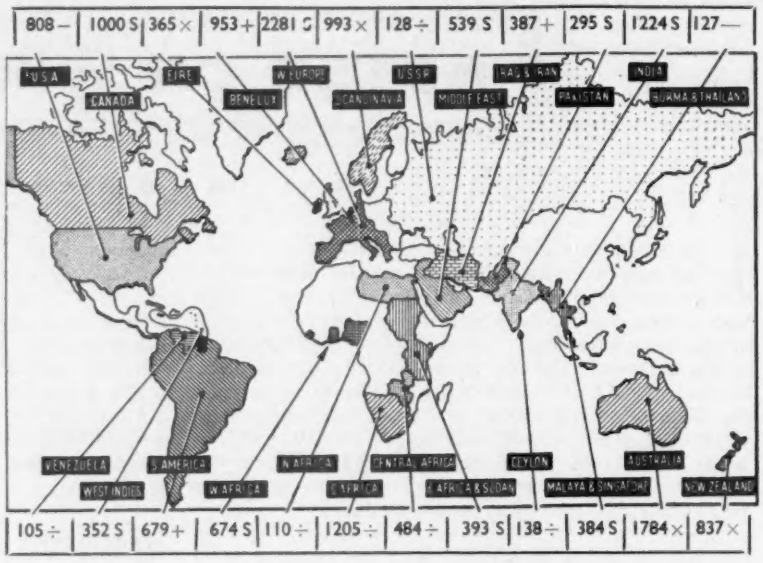
Fixings

With the progress of new developments in concrete it is fairly common knowledge that the necessary fixings for conduits, etc., make harder work for the site operative. Equally, of course, more and better tools have appeared on the market to assist him and lessen his work. Certain concrete mixes are such that the normal hand methods of punching holes are of no use, and, of course, not economical. From visits to sites recently, it appears to me that most contractors favour the drilling method, or the combination of a drill and an attachment which gives a "punch" to the drilling tool. It was surprising to note how few sites were equipped with the cartridge-hammer type of fixing tool.

A few inquiries here and there showed that many cartridge-hammers just did not do the required job. I understand that one strength of cartridge was not sufficient to drive the fixing home, yet a stronger one drove it to buckling point. Although these guns were said to be "speedy and economical" they turned out to be very different. My informant did, however, point out that concrete varied considerably and this was partially to blame as there were "hard" spots in the mix where flints had come together. I feel that this type of gun is still useful in the industry but not for the smaller fixings for conduit or m.i.c.c. cables. Its main use appears to be where battens, etc., require fixing into position and as the spike or nail has to be fired through the batten itself, a good fixing can be obtained quickly and economically. Meanwhile, the drill will have to suffice—with the odd assistance from the old plugging tool and hammer.

Distribution of Exports in £'000's Sterling

×=over 25% increase
+=10% to 25% increase
$=10%+ to 10%−
−=10% to 25% decrease
÷=over 25% decrease
on previous year's figures.



EXPORTS IMPORTS

June

A REDUCTION of nearly £3 million compared with the corresponding figure for May and the lowest total for the year—that is June's unfortunate record for Britain's electrical exports. The previous lowest total this year was £21,650,742, for January. Nevertheless, the figure for June was slightly above that of a year ago, mainly due to larger exports of radio and electronic gear. In the domestic appliance sphere, small reductions were recorded for most articles, the exception being washing machines, which achieved a small increase.

Of the fans sent abroad during the month, £101,004 was for the ceiling type, and £31,888 for desk fans and parts.

Once again, exports of cables show a decline in value, being over £180,000 down on the previous month.

Of the month's exports to the various parts of the world, the improvement in trading with Western Europe, including the Benelux countries, continues. Australia was our best customer, taking goods to a total value of over £1,784,000, with South Africa some way behind with £1,205,355, and Canada only just topped the £1 million mark.

On the import side, it will be seen that the total for June is nearly £628,000 less than that for the previous month, the largest reduction being for domestic refrigerators, which dropped to £670,341.

Description	Exports Value (£)		Imports Value (£)	
	June 1959	June 1960	June 1959	June 1960
Generators				
Diesel up to 200 kW	403,872	323,959		
Diesel over 200 kW	407,693	260,828		
Steam turbine driven	52,276	164,850		
Water and gas turbines	292,204	193,469	75,467	81,091
With i.c. and other prime movers	87,269	47,684		
Generators up to 200 kW	101,948	50,250		
Generators over 200 kW	78,651	75,906		
Generator parts	416,477	742,941		
Motors, f.h.p.	205,002	254,050		
Motors 1-250 h.p.	355,002	383,482	127,792	189,864
Other motors	581,518	202,683		
Motor starters and controllers	340,385	254,619		
Converters and rectifiers	160,721	138,465	98,137	157,016
Transformers	775,845	587,764		
Switchgear, to 200A, mv	273,430	503,686	97,422	112,071
Switchgear, other	1,307,630	953,772		
Total, Electrical Plant	*5,839,923*	*5,138,408*	*398,818*	*540,042*
Batteries, primary and parts	408,963	562,127		
Lamps, filament, over 28 V	85,168	89,390		
Lamps, filament, under 28 V	20,602	26,121		
Fluorescent and other lamps	84,958	112,827		
Radio and electronic gear	2,662,127	3,742,339	1,543,623	1,359,427
Telephone and telegraphic equipment	1,743,972	1,583,721		
Cookers	34,607	30,517		
Toasters	12,521	14,682		
Other cooking appliances and parts	130,098	125,285		
Space heaters	30,084	11,025	66,292	143,686
Water heaters	26,935	24,619		
Other heaters and parts	88,028	103,783		
Electric irons	64,070	71,942		
Vacuum cleaners	130,830	130,673		
Floor polishers	70,741	52,887		
Food mixers	46,358	65,233		
Washing machines, domestic	312,943	403,863		
Dryers		45,251		
Washing machine and dryer parts	73,769	184,636		
Domestic refrigerators and parts	581,776	730,720	464,334	670,341
Other appliances and parts	185,366	335,827		
Total, Domestic Appliances	*1,788,126*	*2,330,942*		
Portable power tools	171,763	243,904		
Arc welding plant	91,287	98,909	70,626	71,697
Resistance welding plant	25,362	51,416		
Electric furnaces	39,207	62,848		
Signalling apparatus	311,648	135,159		
Commercial instruments	157,641	185,702	180,008	145,272
House service meters	130,726	131,862		
Wiring accessories	164,007	210,902		
Fans	130,029	132,892		
Lighting fittings and lanterns	275,167	344,380		
Other lighting equipment	45,807	87,416		
Telephone and telegraph cable	399,840	348,408		
Paper insulated cables	489,381	454,450		
Rubber insulated cables	276,041	251,938		
Thermoplastic insulated cables	252,991	255,643		
Winding and similar wires	105,870	118,284		
Other cables and wires	112,308	186,462		
Total, all cables and wires	*1,636,431*	*1,615,185*		
Accumulators and parts	317,764	277,922		
Insulating materials	204,227	168,393		
Electrical ware	92,757	99,839		
Industrial electronic control gear	112,868	197,933		
Permanent magnets	47,048	57,058		
All other articles	2,258,018	2,402,433	1,180,697	1,882,927
Total	18,845,595	20,090,029	3,904,398	4,817,392

OVERSEAS NEWS

from our correspondents abroad

CANADA

Iron Ore Venture

A plan to mine iron ore in the Lake St. John area of Quebec has been revealed by mining promoter Dan Keefe, of New York. Work on the mine is to start very shortly and production eventually will reach 2,000 to 4,000 tons a day. Among those said to be behind the venture are oil-magnate Mr Paul Getty and the Greek shipping millionaire, Aristotle Onassis. The latter is stated to have a 50% interest in the venture. The open-pit mining operation will be done by Commonwealth Getty Mining Co. of Canada Ltd., currently being incorporated in Canada. A subsidiary, Inter-Ocean Exploration Co. of Canada Ltd., holds a 10,000-acre concession in Tache and Bourget townships near Isle Maligne, some 120 miles north of Quebec City. The area has not previously been known for minerals, but is abundant in hydro-electric resources.

U.S.A.

Low Tender

The lowest tender for the supply of two propeller-type turbines for the proposed Melton Hill dam has been submitted by the English Electric Co. Ltd., it is reported. Their price is $1,730,070, the next lowest being that of $1,829,300 by the American Elin. Nearest American tender is that of Baldwin-Lima Co.

SCANDINAVIA

380 kV Line

The Swedish and Norwegian authorities have approved a scheme for erecting a 380 kV power line across the border between Borgvik, in the Swedish province of Värmland, and Skjeberg, near Sarpsborg, in Norway. Denmark, Finland, Norway and Sweden will then be joined in one of the world's biggest power link-ups. The new line will have a capacity of 400 MW. Earlier this year a 200 MW line between Sweden and Norway was put into operation across the mountain ridge in the Jämtland region. The total cost of the new line will be Kr 40,000,000 (£2,750,000) and the work is scheduled for completion by July, 1963. The line will facilitate Swedish deliveries of power to Norway during the summer while, during the winter, the large Norwegian reservoirs will make possible deliveries of electricity in the opposite direction.

SUDAN

Multi-purpose Scheme

As the first step in the implementation of a plan for another combined irrigation and hydro-electric power project the Sudan Ministry of Irrigation and Power is to call for tenders for the construction of a 350 m. long and 55 m. high dam across the Atbara River, some 4 km upstream of the town of Khashma el Girba. Consulting engineers for the project are Societe Grenobloise d'Etudes et d'Applications Hydraulics, of France.

CONGO

Aid Needed

In the recent troubles in the former Belgian Congo all the Belgians employed in the Electricity Department at Leopoldville have left that area we understand. As part of Ghana's aid to the Congo in the present disturbances, Mr B. O. Otoo, senior electrical engineer, has gone to Leopoldville.

RHODESIA

Kariba—Next Move

Responsible for much of the early work on the first stage of the Kariba hydro-electric project, the Cementation Co. (Rhodesia) Ltd. has been awarded a contract to do exploratory work for the second stage of the scheme. That stage will comprise the installation of an underground power station on the north bank of the Zambezi at Kariba. When the exploratory work is complete, a final decision on the design and siting of the station will be possible. But the actual start on constructional work will depend on the need of the Federation for an additional power station. The first stage is to have six 100 MW generators, but output of the second stage will probably be 50% greater.

INDIA

Loan for Kanpur

The US Development Loan Fund has approved a $1·6 million (Rs76 lakhs) loan to cover the foreign exchange costs of an extension to the Kanpur thermal power station. This will consist of a 15 MW turbo alternator, complete with boiler, switchgear and associated equipment. Service connections and 120 miles of line are also included in the project. The design for the extension has already been completed and orders for major equipment are being placed with European suppliers. The Kanpur plant is the sole source for the supply of electricity in its area, which includes, in addition to Kanpur, the city of Unnao and 11 other towns.

PAKISTAN

Multi-purpose Plan

A multi-purpose scheme to utilise the Karnaphuli is the subject of a preliminary report drawn up by the Associated Consulting Engineers, of Pakistan. It considers rural electrification prospects in East Pakistan both economic and feasible. It has been recommended that there are good opportunities for combining the power needs of reclamation and irrigation with those of rural electrification, small industries and also of tea gardens. The total cost of reclamation has been estimated at about Rs22,80,00,000. According to present plans two 40 MW sets would be installed at Karnaphuli, with provision for the addition of a third machine at a later date.

AUSTRALIA

Station Opening

Port Augusta "B" power station of the Electricity Trust of South Australia, was officially opened by the Premier, Sir Thomas Playford, last Thursday. The station is to have three 60 MW turbo-generators manufactured by the English Electric Co. The Port Augusta "A" station has three Parsons 30 MW sets.

Rod Mill Order

An order worth about £700,000 for electrical equipment for a new rod mill has been obtained by the Heavy Plant Division of Associated Electrical Industries Ltd., from the Broken Hill Proprietary Co. Ltd., Australia. The mill will be driven by d.c. motors ranging in output from 600 to 2,500 h.p., and the total power available will be 17,700 h.p. Mercury-arc rectifiers, rated in all at 13,000 kW, will supply the mill motors. Switchgear, control gear, auxiliary drives, and other equipment are included in the order. Most of the electric control equipment required will be manufactured in Australia by Australian Electrical Industries (Proprietary) Ltd. Responsibility for manufacturing the rest of the equipment will be divided between the Rugby and Manchester (Trafford Park) AEI works.

Personalities *in the industry*

Mr T. G. Allcock

Mr E. Vaughan-Williams

Mr G. W. Richards

Mr A. G. Milne

Mr L. Locker

The National Executive Council of the Electrical Power Engineers' Association has approved the appointment of **Mr T. G. Allcock,** Midlands area secretary, to the new position of senior assistant secretary at EPEA head office. He will be employed on general negotiating duties, but will give particular attention to the interests of managerial members. Mr Allcock started his career with an apprenticeship in the Hereford Corporation electricity department. In 1937 he became assistant control engineer at Stourport power station and was occupying the position of assistant charge engineer when he joined the association's permanent staff in 1951.

Deputy station superintendent at Rogerstone power station, South Wales Division, CEGB, since June, 1957, **Mr E. Vaughan-Williams,** A.M.I.E.E., has been promoted to station superintendent there (*ESH, page 64). He succeeds **Mr W. H. N. Clarke,** A.M.I.E.E., A.M.INST.F., who, as we earlier reported, has been appointed station superintendent at Uskmouth "B." Mr Vaughan-Williams began his career in the industry at Llynfi power station in 1949, where he held various posts before going to Rogerstone.

Mr R. W. Cross, A.M.I.E.E., DIP.M.I.E.S., has become a partner in the consulting engineer firm of T. Dunwoody and Partners.

Mr J. A. Christie, district commercial engineer for the North Western Electricity Board at Chorley, has been elected president of the Leyland Rotary Club.

The Minister for Science has reappointed the **Rt Hon Lord Citrine,** P.C., G.B.E., LL.D., **Sir James Chadwick,** F.R.S., and **Mr C. F. Kearton,** O.B.E., as members of the United Kingdom Atomic Energy Authority when their present terms of office expire. Lord Citrine's reappointment will commence on 1 Jan., 1961, and will normally terminate on 31 Dec., 1961. Sir James Chadwick's reappointment will commence on 21 Aug., 1960, and will normally terminate on 20 Aug., 1962. Mr Kearton's reappointment will commence on 17 Oct., 1960, and will normally terminate on 16 Oct., 1965.

Formerly senior technical sales representative with W. Lucy and Co. Ltd., of Oxford, for a number of years, **Mr R. D. Johnson** has taken up the position of group sales manager with the Denis Ferranti organisation.

Mr F. E. Pomeroy, a director of Nalder Bros. and Thompson Ltd., who is well known in the measuring instrument section of the electrical industry and for his service on a number of BEAMA Committees, has retired after 47 years' service with the company. Mr Pomeroy started his electrical career in Nalder's drawing office and, after a few years, took charge of the Estimating Division. In 1941 he became assistant manager of the company, and in 1951 was appointed a director. At a recent gathering in the company's canteen, presentations were made to him by his fellow directors and staff and works personnel.

Mr W. H. Everard, deputy general manager of the Foundry Division of Edgar Allen and Co. Ltd., has been elected president of the British Electric Steel Makers' Guild.

An inscribed gold wrist-watch and pen and pencil set were presented to **Mr J. E. Macfarlane,** B.SC.(ENG.), M.I.E.E., A.M.I.MECH.E., head of the department of electrical engineering at the City of Liverpool College of Technology on 15 July on his retirement after 21 years' service. During this period the work of the college has changed and it is now a regional college of technology concerned with advanced work in electrical engineering. The presentation was made by Principal S. A. J. Parsons, supported by Mr D. Chalmers, who will be acting head of the department until a new appointment is made. Mr Macfarlane, who will continue to reside on Merseyside and maintain his interest in education, has been a frequent contributor to the pages of the ELECTRICAL TIMES.

Mr George W. Richards, ASSOCIATE I.E.E., Bristol manager and adviser for the South Western Electricity Board's Bristol and Somerset group of districts, has retired after 46 years' service in the electricity supply industry. At an informal ceremony last Thursday, Mr A. N. Irens, chairman of the board, presented him with a portable transistor radio set and a pair of pipes subscribed to by his colleagues. Mr Richards' successor as Bristol district manager is **Mr A. G. Milne,** M.I.E.E., A.M.I.MECH.E., A.M.B.I.M., but we understand that the position of adviser to the Bristol and Somerset groups (formerly held by Mr Richards) is being discontinued. Mr Milne has been the board's deputy chief engineer since 1951, a position which will be taken over by **Mr L. Locker,** A.M.I.E.E., now group engineer for Bristol (*ESH, pages 97, 98). Mr Richards first went to Bristol in 1948 (when the supply industry came under public ownership) and was the board's deputy Bristol manager from 1949 to 1957 when he was appointed Bristol manager. His early training as a pupil apprentice in mechanical engineering was followed, in 1914, by a year with the Urban Electric Supply Co. in Cornwall. After war service he joined the Cornwall Electric Power Co. and was later promoted to district manager and then sales manager. From 1934 to 1948 he was the company's commercial manager and deputy to the general manager; in 1948 he was appointed deputy chief commercial officer of the S.W. Electricity Board. Mr Richards has also been the board's representative on the S.W. regional board for industry since 1951. Mr Milne, who is 50, has been the board's deputy chief engineer since 1951. After taking an Honours Diploma in electrical engineering at Faraday Hse, he received his early training as a pupil apprentice with C. A. Parsons and Co. Ltd. In 1934 he joined the County of London Electricity

*(*Denotes revision to the "Electricity Supply Handbook, 1960."*

Supply Co. as a charge engineer and two years later was appointed assistant works manager of Thomas Firth and J. Brown Ltd., of Sheffield. From 1935 to 1945, Mr Milne was on the engineering staff of the Yorkshire Electric Power Co. and then served for two years with Blackburn Corporation Electricity Department as technical superintendent. In 1947 he was appointed deputy city electricity engineer at Bath and, from 1948 to 1951, was the S.W. Electricity Board's Bath district manager. Mr Locker, who is to be the board's new deputy chief engineer, became responsible for the board's engineering work in Bristol, Bath, Weston-super-Mare and a wide area of North Somerset in April, 1957. He started in the industry with the Rotherham Corporation undertaking. After war service he joined the Bath electricity undertaking in 1946 as testing and substation engineer and, in 1948, was appointed senior technical engineer of the Cornwall sub-area of the SWEB. In April, 1950, he was promoted deputy sub-area engineer, Cornwall, and two years later became district manager, East Cornwall.

Mr D. A. F. Donald, chairman and managing director of National Cash Register Co. Ltd., has been appointed chairman of G. A. Harvey and Co. (London) Ltd. **Sir Thomas Overy** has resigned the chairmanship on medical advice, but remains a director of the company.

Newly elected president of the Canadian Electrical Association is **Mr David Cass-Beggs,** M.SC.(TECH.), M.I.E.E., general manager of the Saskatchewan Power Corporation.

General manager of the Toronto Township Hydro-Electric Commission for the past 11 years, **Mr R. H. Starr** retired earlier this month.

The BBC has announced the appointment of **Mr P. E. F. A. West,** M.A., A.M.I.E.E., as West Regional engineer in succession to **Mr G. Daly** who is to retire at the end of September. For five years, from 1951, Mr West was assistant to the BBC's chief engineer. Since then he has been engaged on the engineering side of the Corporation's external services. Mr Daly joined the BBC in 1925 and after two years at Savoy Hill became engineer-in-charge at Gloucester. In 1933 he was appointed engineer-in-charge for the West Region.

After 47 years' service with the Hydro-Electric Power Commission of Ontario, **Dr Otto Holden** retired on 14 July. For the past five years he has been chief engineer to the commission. He should have retired four years ago, at the normal retirement age of 65, but this would have meant leaving when the St. Lawrence power project, with which he was prominently concerned, was nearing fruition. He was urged to stay on and needed no second invitation. Dr Holden has, in fact, been associated with most of the commission's power projects since he was appointed chief hydraulic engineer in 1937. Ten years later he became assistant general manager, engineering, and was promoted to chief engineer in March, 1955. In his honour, the commission's La Cave plant on the Ottawa River, officially opened in June, 1952, was renamed the Otto Holden generating station.

Mr G. Patterson, of Detroit, has been elected as president and a director of the Yale and Towne Manufacturing Co. in succession to **Mr G. W. Chapman** who has retired. Mr Patterson is also a director of the Square D company and was serving as president and director of the Electric Controller and Manufacturing Co., of Cleveland, Ohio, when it was merged with Square D.

Following the promotion of **Mr G. H. Tilbrook,** A.M.I.E.E., as sub-area manager of Suffolk, **Mr H. E. Judd** has been appointed as engineer of the Suffolk sub-area of the Eastern Electricity Board (*ESH, page 111). Mr Judd, educated at Tottenham Grammar School and the Hackney Technical Institute, obtained his training with the Northmet Power Co. which he joined in 1931. On nationalisation of the industry he was appointed to the development section of the chief engineer's department later becoming senior assistant engineer.

Retiring after 31 years' service in the industry, **Mr W. B. Chivers,** district accountant at Melksham to the Southern Electricity Board, was recently presented with a refrigerator, subscribed for by colleagues. The presentation was made by **Mr J. C. Fitzmaurice,** district manager.

Station superintendent at Bath power station, South Western Division, CEGB, since 1953, **Mr W. Sinclair,** A.M.I.E.E., A.M.I.MECH.E., retires at the end of this month. His successor is **Mr E. Hindley,** who has been station superintendent at Exeter. (*ESH, page 63.)

Until recently personal assistant to the managing director of the Troughton and Young group of companies, **Mr P. E. M. Sharp,** A.C.G.I., B.SC.(ENG.), A.M.I.E.E., has been appointed general manager of Westrex Co. Ltd. He was educated at St. Paul's School and City and Guilds College where he took his degree in telecommunications. Earlier he was with the Telegraph Construction and Maintenance Co. Ltd. and Standard Telephones and Cables Ltd. Mr Sharp is an authority on industrial design, a contributor to *Design Magazine* and other journals. In 1959 he won a Ford Foundation Travel Grant to the United States.

Head of the Electrical Engineering Department at Garretts Green Technical College for the past two year, **Mr D. A. Crowther,** B.SC.(ENG.), A.M.I.E.E., has been selected for the position of Principal of Kingston Technical College, Jamaica.

Readers who have followed reports of the single-handed yacht race across the Atlantic may be interested in its double link with the electrical industry. The arrangements for the race have been partly in the hands of **Mr C. Brasher,** the son of the IEE secretary; and the winner of the race, **Mr Francis Chichester,** is brother-in-law of Brigadier W. G. Thompson, chief executive officer of the NICEIC.

Mr H. S. Payman, managing director of B and R Relays Ltd., is now on a business visit to Israel.

Mr G. M. B. Briggs has been appointed home sales manager to Electroway Heaters Ltd. and will take up duties in September.

Chairman and managing director of the General Electric Co. Ltd., **Sir Leslie Gamage,** M.C., M.A., is relinquishing those positions. Earlier this week he said: "During the three years of my chairmanship I have devoted myself mainly to the reorganisation of this great company and the restoration of its profitability. That reorganisation plan is now finally set, though it may take a year or two before its full effect is felt in the results. Last year's results indicate that, given reasonable economic conditions, the company can recover its prosperity. Under these circumstances, I have to realise that the task I have set myself is nearly done, and it is time for me to take a less active part so as to allow younger men to build upon these better foundations. I am, therefore, relinquishing my executive duties as managing director, though I shall be continuing as chairman until the end of the year." As a result, **Mr A. L. G. Lindley,** M.I.MECH.E., becomes the sole managing

Mr P. E. M. Sharp

Mr H. E. Judd

Sir Leslie Gamage

Mr A. L. G. Lindley

director as well as vice-chairman. The name of the new chairman has yet to be announced. This decision of Sir Leslie to relinquish executive duties immediately will be regretted by many in the Industry—for his connection with GEC is a long one, going back to 1919. Just after the First World War he married Miss Muriel Hirst, the elder daughter of Lord Hirst. He became secretary of GEC in 1920, and on election to the board in 1925, while retaining the secretaryship, also undertook the particular responsibility for export business, in which sphere he subsequently played a great part in the development of the business, visiting all parts of the world. His responsibilities were further extended when, in 1941, he and Sir Harry (then Dr A. H.) Railing were appointed general managers of the company. Two years later he became vice-chairman and joint managing director with Dr Railing who was then also chairman. Sir Leslie, who was awarded a knighthood in 1959, was president of BEAMA in that year and was president of the Institute of Export from 1942 to 1958, in addition to serving on many other organisations.

Mr W. L. Harrison has been appointed manager of the Furnace Division of G. W. B. Furnaces Ltd. This follows the recent death of Mr A. V. Francis. The company state that in future the division will operate as two units, one dealing with melting and the other with heat treatment processes. **Mr J. Simpson** will be sales manager (melting), and **Mr J. Nicholls** will be sales manager (heat treatment). In addition, **Mr A. Head,** for many years chief draughtsman, has been appointed chief designer.

The South Wales Electricity Board announce the forthcoming appointments which will become effective upon the retirement at the end of March next year of **Mr A. J. Dalton,** A.M.I.E.E., as chief commercial engineer. Mr Dalton has held that position since April, 1959, and had previously been deputy chief commercial engineer since vesting day. **Mr D. G. Gwyn,** B.SC., A.M.I.E.E., has been appointed to succeed Mr Dalton as chief commercial engineer. Mr Gwyn, who was appointed a member of the board in Oct., 1959, is at present manager of the Monmouthshire and Mid-Wales subarea. When Mr Gwyn takes up his appointment as chief commercial engineer, he will be succeeded as manager of the Monmouthshire and Mid-Wales subarea by **Mr W. E. Richardson,** M.I.E.E., who is now manager of the West Wales sub-area. (*ESH, pages 129, 130 and 133.)

Several new appointments are announced by Charles Colston Ltd. **Mr L. B. Smith** has been promoted manager of the Scottish branch, **Mr J. A. Mathers** becomes senior training manager, and **Mr H. G. M. Coleman** has been transferred from the Training Division to the Southern branch, where he will be electricity board liaison manager for the Southern district. In the Southern branch's London district, **Mr D. L. Stanley** becomes an area manager; in the Northern branch, **Mr R. Hetherington** is now North Eastern district manager; and **Mr H. H. Tassell,** the North Western district manager. **Mr F. A. Taylor** is appointed an area manager. **Mr F. E. Fellowes** is now an area manager in the Merseyside and North Wales branch, and **Mr C. Hill** has been appointed electricity board liaison manager for the East Midland district. In addition, **Mrs Z. A. Cawley** has been appointed chief lady demonstrator of the company's Electrical Appliance Division.

Viscount Margesson, having reached the age of 70, has decided to retire from the board of the General Electric Co. Ltd. He has been a director of the company since 1942.

A Production Engineering Department has been formed at the Newhouse (Lanarkshire) factory of Honeywell Controls Ltd. Manager of the department is **Mr A. Gordon,** B.SC., A.M.I.PROD.E., A.H.W.C. In addition, **Mr J. Hughes,** B.SC., has been appointed quality manager at the firm's works.

OBITUARY

M. André Coyne, a noted French hydro-electric expert, died on 21 July, aged 69. He designed the dam for the Kariba project and was associated with many other hydro-electric schemes.

Mr A. E. Diggens, Divisional sales manager of Nife Batteries, died on 23 July.

Mr E. W. Jackson, A.M.I.E.E., F.C.S., who died on 19 July, aged 77, was deputy sales engineer of Hackney Borough Council Electricity Department for a number of years. Prior to joining that undertaking in 1923 he served with the West Ham Corporation undertaking, the General Electric Co. and the Brompton and Kensington Electric Supply Co. He had also been a lecturer on "Electrical Housecraft" to candidates for the EAW examinations. Outside the industry, he was a past-president of the St. John Ambulance Brigade Officers' Club, being associated with the St. John Ambulance Association for many years.

At the inquest on the death of **Sir Raymond G. Hart,** M.I.E.E., (reported last week) who was killed while using an electric lawn mower, it was stated that he had made an extension lead with pin connectors at both ends. The coroner remarked that Sir Raymond "was a victim of the science to which he devoted so many years of study."

NEW LITERATURE

Industrial Electronics and Control

by R. G. Kloeffler.

THE author of this volume is a professor of Electrical Engineering at Kansas State University and this is the second edition, the first having appeared in 1949. Written to give the engineering student a survey of the theory and applications of electronics in industry, it is, perhaps, significant that the relatively new field of semiconductors is accorded an early place in the revised work, now occupying the third chapter in front of electron emission and vacuum tubes. Profusely illustrated and not overburdened with mathematical formulae, it gives a clear, concise picture of the field of applied electronics as it is today. Each chapter finishes with a few problems which the student should have little difficulty in solving if he has studied the context which goes before. Other interesting chapters are those on high frequency heating, X-ray applications and principles of electronic computers. Published by Chapman and Hall, 533 pages, 9 in. by 5¾ in., 450 illustrations. Second edition. Price 80s.

Colliery Year Book, 1960

WHETHER the regional arrangements of the National Coal Board are shortly to be reorganised or not remains to be seen, but for those needing an up-to-date appraisal of various aspects of the NCB, the answer is to be found in this 1960 edition. The statistics include labour employed, output, costs of production, etc., at the individual mines covering many years. Officials are also listed. World production and imports of solid fuel by various countries is tabulated, and with complete details of all the Mines and Quarries Regulations, the volume provides an unparalleled wealth of information on this industry. Published by Iliffe and Sons, 916 pages, 8¾ in. by 5½ in. Price 40s.

BOOKS RECEIVED

Electron Tube Life Factors, ed. by C. Walsh and T. C. Tsao. Gives detailed information on changes in properties over a 5,000 hr life of a number of American receiving-type valves used in military electronic equipment. Published by Interscience Publishers, 88 Chancery La, W.C.2, 173 pages, 11 in. by 8½ in. Price 72s.

Electromagnetic Fields, Energy and Forces, by R. M. Fano, L. J. Chu and R. B. Adler. First-term American text-book, being further work resulting from revision of electrical engineering course at MIT. Published by Chapman and Hall, 520 pages, 9 in. by 6 in. Price 96s.

Proceedings of the Symposium on Millimeter Waves, ed. by J. Fox. Symposium of April, 1959, on millimeter waves held at the Polytechnic Institute of Brooklyn Microwave Research Institute. Published by Interscience Publishers Inc., 656 pages, 8¼ in. by 5¼ in. Price $8.

Numerical Methods for High Speed Computers, by G. N. Lance. Information for programmers preparing mathematical and engineering problems for solution on electronic computers. Published by Iliffe and Sons Ltd., 166 pages, 8½ in. by 5½ in. Price 42s.

Television Explained, by W. E. Miller. Revision of well-established introduction to television set circuitry. Published by Iliffe and Sons Ltd., 192 pages, 8½ in. by 5¼ in. Seventh edition, price 12s 6d.

POWER SUPPLY

Statistics for June

THE month of June saw the completion of an important stage of the CEGB development plan for larger plant installation with the commissioning of the fourth set at Blyth "A" and the official opening of the station by Mr J. C. Mitchell, former controller of the north eastern division.

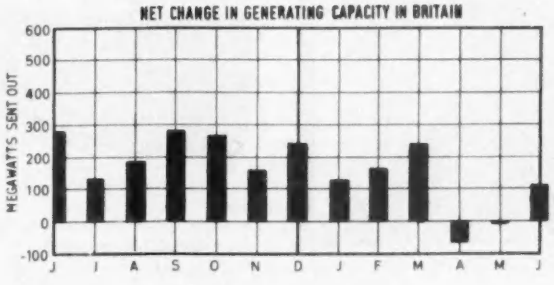
Blyth "A" was the first station to have 120 MW sets installed. These were built by AEI (Metropolitan-Vickers) and are supplied from 860 klb/hr Babcock and Wilcox boilers designed for steam conditions of 1,600 lb/sq in. 1016°F with reheat. No plant was commissioned by either the SSEB or the NSHEB during the month.

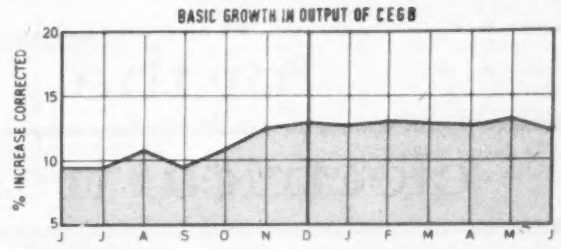
Once again, the national figures for units sold by the CEGB, when corrected for average daily temperature and working days during the month, follow the monthly trend apparent for the earlier part of the year at 12·2%, although the actual increase on June, 1959, was only 7·8%. In June the increase to those areas which are not mainly industrial was slightly higher at 8·7% while the increase for the industrial areas was 7·2%. Supply increases over June, 1959, exceeding 10% are recorded by the Eastern, Southern and South Eastern boards.

Electricity Board Sales in June

Board	Electricity sent out in millions of units	% increase on June 1959
London	504·0	5·1
South Eastern	389·2	10·3
Southern	522·0	10·2
South Western	247·5	5·1
Eastern	638·9	10·9
East Midlands	552·8	6·6
Midlands	712·4	4·8
South Wales	448·5	8·8
Merseyside and N. Wales	456·4	9·2
Yorkshire	737·6	8·1
North Eastern	423·1	8·4
North Western	714·2	6·2
Direct supplies by CEGB	299·0	9·3
CEGB Total	6,645·6	7·8
South of Scotland	519·0	8·2
North of Scotland	112·6	7·3

This table excludes area board purchases from other sources

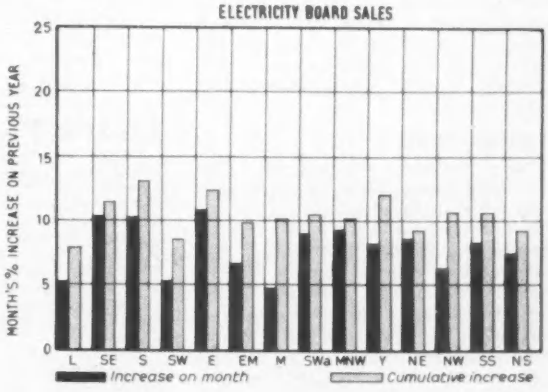


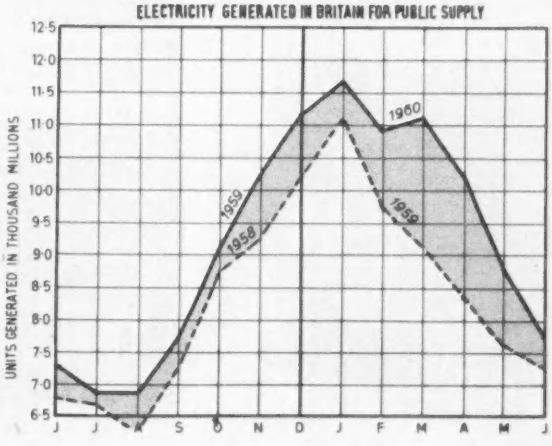


Turning to the generation of electricity, the total output capacity of the CEGB rose during the month by 115 MW to a total of 25,652 MW. There was no change for either of the Scottish boards and the total for the country rose to 28,351 MW.

The seasonal fall in consumption was responsible for a reduction in the number of units generated by the CEGB to 7,242 million compared with 10,779 million units in January, but on the other hand, still 7·5% higher than in June last year. Generation by the SSEB was 7% lower than in June, 1959, at 405 million units, while the NSHEB showed a slight increase at 135 million units.

Total generation by the three boards was thus 7,782 million units of which 7,301 million units were sent out for public supply, an overall increase of 6·7% on June, 1959. For this increase of 6.7% units generated, coal consumption increased, for the three boards, by 4·7% to 3,084 thousand tons. Oil consumption increased by 14·2% to 362 thousand tons or 11% by weight of the coal consumption. Despite increased coal consumption by power stations their stocks have also fallen during the same period by slightly under a million tons to 5·71 million tons.





for the electrical trade

GEC's modern-trend heaters

TWO new heaters of arresting modern design have been added to GEC's range of domestic fires. They have the austere straight edges which are so much part of the present trend, economy of line offset by interesting colour contrasts. The larger unit, designed to stand before a fireplace, employs the increasingly favoured system of combined radiation and convection, background heat in this case being provided by the 500 W convector. The main heating unit comprises two 1 kW elements mounted vertically in a dispersive reflector which gives a more even distribution of warmth. The convector and the two elements have independent control. The screen below the radiator is lit whilst the convector unit is in operation. This fire, "Cosyglo" D2810 is priced at £15 15s tax paid. Finish, hammered texture stove enamel.

The other is a less expensive model, portable this time and without the convector or the lighting unit. Finish is black and red. Price £6 10s retail tax paid. "Cosyglo," Cat. No. D2819. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

Austrian 'fridge

THE Austrian manufacturers Elin-Union have entered the market here with a 4·9 cu ft refrigerator, TEK 140. It is a compressor model with automatic interior lighting and a flat table top. This cabinet seems wide and deep for its 35 in. height in comparison with some of the extra slim models which have been on the market recently. Its broad table top is certainly practicable. It has a really big freezer and a capacious crisping drawer at the bottom. Door space carries an egg rack, two dairy produce compartments and a shelf for the tallest bottles. The unit is a sealed "Tecumseh" compressor. TEK 140 is priced £66 3s including purchase tax. *Rustone Trading Co., 56 Whitcombe St, W.C.2.*

Stove/'fridge/sink set

A REFRIGERATOR and an electric stove in one unit which incorporates a sink and draining board are offered in one of the biggest space-savers yet, "Compacta." The whole combination occupies only 8 sq ft of floor space. Four 1,250 W surface units are provided on the cooker, which has a 5,000 W oven of reasonable size. The refrigerator, an absorption type claimed to have 5 cu ft capacity at least, is equipped with a large horizontal freezer. Careful attention has been paid to insulation between the two units. The dividing wall is hermetically sealed and filled with compressed fibreglass, heat transfer being further discouraged by gaskets on both doors. "Compacta" three-in-one is 3 ft high and retails at about £175 minimum, tax paid. *General Trade Equipment, 82 Seymour Pl, W.1.*

TRADE PUBLICATIONS

ELSTEIN.—Infra-red equipment for all applications. A leaflet by P and R Electrical (London) Ltd., Pearl Hse, Berrymead Gdns, W.3. New Elstein price list of sealed ceramic elements and equipment also available.

BROWN LENOX.—26-page selection guide to steel castings. Brown, Lenox and Co., Pontypridd, Glamorgan.

VACTRIC.—New technical data (abridged) leaflet on precision Servo components from Vactric (Control Equipment), Sloane St, S.W.1.

PH.—Descriptive leaflet on flexible pipe-bandages from PH Thermal Products Ltd., Baildon, Yorks.

"Mixmaster" junior

SUNBEAM have followed up the introduction of their full-size food mixer, "Mixmaster," with a smaller "Junior" model at £14 10s. Supplied complete with a three-pint bowl and stand the new model is readily detached from its base for use as a hand mixer. Like its larger counterpart "Junior" has three-speed control and double paddles, the casing and handle being attractively styled in white plastics. *Sunbeam Electric, East Kilbride, Glasgow.*

Fan heater price increase

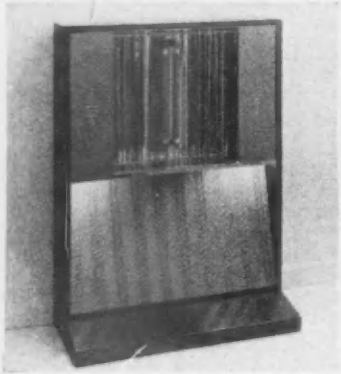
PHILIPS ELECTRICAL LTD. announce an increase in the price of their "Phantom" fan heater. As from 1 Aug. the heater will be raised from £8 12s 6d. to £8 19s 6d tax paid.

PVC screw anchors

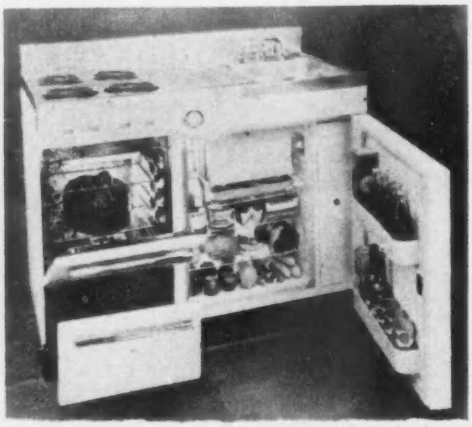
"EXPANDET" screw anchorings are a type of wall plug made of tough p.v.c. They consist of short lengths of tubing of irregular cross-section, which can be hammered into a screw hole without fraying. The p.v.c. is strong and resilient and expands readily as the screw is driven, providing it with a secure hold and a corrosion-resistant covering. The plugs are produced in a number of sizes distinguished by colour, taking wood and coach screws up to ½ in. bore. *Expanded Plugs Ltd., 9 College Hill, E.C.4.*

Panoramic heat radiation

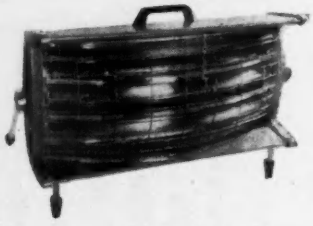
CURVED elements in the "Panorama" fire allow heat to be radiated over an extra large area. This unusual heater utilises two 1 kW elements mounted parallel with each other in similarly bow-shaped reflectors and is said to radiate heat throughout an angle of nearly 180°. The curved reflectors are highly polished aluminium set in a hammered aluminium and steel casing. The 20 in. silica sheathed elements, which may be switched on separately, are guarded by a plated wire screen quickly released for polishing the reflectors. "Panorama" is a freestanding portable model approximately 15 in. high and 25 in. wide. Price £11 19s 6d including purchase tax. *Therm-air Domestic Appliances, Izons La, Oldbury Rd, West Bromwich.*



GEC's smart "Cosyglo" fire, £15 15s



The mammoth 3-in-one "Compacta" stove 'fridge/sink unit



"Panorama" has curved front for wider angle radiation, £11 19s 6d

equipment for industry

Germanium rectifiers

RECENT entrants to the semiconductor rectifier manufacturing industry are J. Stone and Co. who market two ranges of germanium rectifiers. The rectifiers are rated for 10 A and 50 A, respectively, and for peak inverse voltages from 50 to 200 V. These rectifiers are designed to operate with base temperatures not exceeding 60°C. *J. Stone and Co. (Deptford) Ltd., Semiconductor Dept., Gatwick Rd, Crawley, Sussex.*

Selecting semiconductors

SELECTION at a glance of the number and reference of GEC semiconductor rectifiers for the six commonest single- and three-phase circuits can be made by a recently intoduced calculator. It consists of two circular cards with windows corresponding to the appropriate rectifier configuration in which the reference number appears for selected current and voltage ratings. The card shows the appropriate silicon or germanium rectifiers in the range of semiconductors made by *GEC Ltd., Semiconductor Division, School St, Hazel Grove, Stockport, Cheshire.*

Electronic accessories

A RANGE of miniature jack plugs and sockets and cables connectors have recently been developed for the electronics industry. The jack plug is completely shielded and has only one soldered joint. It is constructed from nickel-plated brass and has a specially designed cable grip. Overall dimensions are 1⅛ in. by ¼ in. diameter. *Rendar Instruments Ltd., Burgess Hill, Sussex*

For transformer insulation

SUPPLEMENTING the well-known "Permali" range of compressed woods is another recently introduced material, "Permawood," a medium density non-impregnated laminate suitable for transformers. It is intended for lead supports and insulating plates where its high mechanical strength can be used to advantage. "Permawood" is intended for oil or Pyrochlor impregnated transformers and its moisture content of less than 7% not only assists drying out, but also is said to result in less distortion than with other materials. Although its electrical strength is only about one-third that of pressboard, its mechanical properties under tension are as much as five times as large. "Permawood" is available in sheets 84 in. by 48 in. with thicknesses from ½ in. to 3 in.

Another introduction is a glass fibre insulator for staywires. This insulator gives greater mechanical strength than its equivalent "Permali" type and is guaranteed for an ultimate tensile strength for a 7/8 swg wire of 18,000 lb. A specially designed collett for locking the glass fibre, ⅜ in. dia, insulating rod into the metal end fittings ensures that pressure is evenly applied and that crimping and distortion are avoided. *Permali Ltd., Gloucester.*

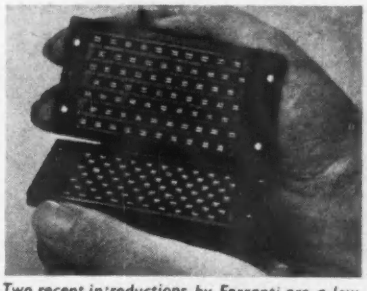
Re-refining oils

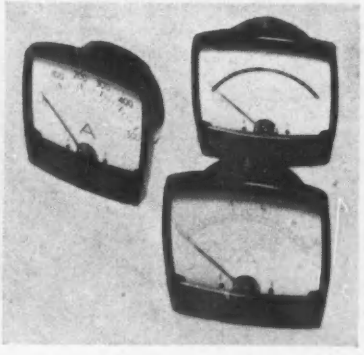
TRANSFORMER oils are among those refined under a collection and delivery scheme operated by Midland Oil Refineries. The refining process includes dehydration, precipitation of oxidised products and other processes including the addition of blending stocks to bring oil up to specification. *Midland Oil Refineries, Bromford La, West Bromwich, Staffordshire.*

Contemporary instruments

IN their style "A" range of moulded case instruments, Ferranti claim to have coupled maximum scale visibility with contemporary appearance and compact design. The meters have a moulded case construction with a rectangular bezel, 2½ in. by 3½ in., and a round body. Scales may be 2½ in. or 3½ in. long with either dagger type pointers and bold lettering for general switchboard use, or finely marked lettering with knife-edge pointers for more accurate reading. The instruments are available in moving coil, moving iron and single element dynamometer wattmeter types. *Ferranti Ltd., Hollinwood, Lancs.*

Multi-pole plug and sockets said to require extremely low insertion and withdrawal forces have been designed for rack-mounted electronic equipment and similar applications. The "Unitor," as this type is called, is available in 35, 70 and 91 ways with silver-plated contacts suitable for 5 A at 500 V. A version for use in polluted atmospheres or where low contact resistance is essential is also available with hard gold-plated contacts. *Ferranti Ltd., Ferry Rd, Edinburgh.*





Two recent introductions by Ferranti are a low-force multi-pole "Unitor" plug and socket, and a new range of moulded case instruments.

Tantalum electrolytic capacitors

SEVERAL valuable advantages are claimed for two ranges of tantalum electrolytic capacitors recently introduced. Among the advantages are lower leakage current and power factor over conventional types of electrolytics, smaller size, extended shelf life, and operation for certain types over a temperature range from −80°C to +85°C. Foil capacitors type TF have a construction using plain or etched foils similar to the dry aluminium capacitor. These cylindrical units are suitable for d.c. peak working voltages from 3 to 150 V and capacitances from 8 to 200μF in the 3 to 12 V range, and 0·5 to 20μF in the 150 V range. They are available in polarised and non-polarised versions. Overall size of these units varies from 1⅛ to 2¾ in. with a maximum diameter of ¾ in.

The solid construction type TS is available in a series suitable for peak working voltages from 6 to 35 V and capacitances from 6 to 40μF at 6 V, to 0·1 to 5μF at 35 V. On both types of capacitors the tolerance measured at 20°C is ±20% and the power factor does not exceed 10%. *Dubilier Condenser Co., Ducon Wks, Victoria Rd, North Acton, W.3.*

Plastics cables and joint boxes

PLASTICS insulated cables with either three or four cores incorporating shaped, compacted conductors have recently been added to the range made by Aerialite. These cables are suitable for voltages up to 3·3 kV and have cross-sections varying from 0·04 sq in. to 0·15 sq in. The range includes cables with p.v.c. insulation, laid up conductors bedded in p.v.c., and galvanised steel wire armoured cables sheathed with tough p.v.c. Suitable for jointing the new cables and for other similar plastics insulated cables is a new plastics power

cable joint. It consists of a two-part mould, the lower part available in different colours for identification purposes and the upper section transparent, enabling the jointer to watch progress during filling. It is claimed that when the resin moulding has cured it results in a high impact strength joint comparable with the familiar cast-iron bitumen filled box. Cold setting resins are used which solidify within 30 min. The joint may be buried within a short time of mixing the compound and tests have shown that no ingress of moisture between the resin and cable sheath occurs. *Aerialite Ltd., Castle Wks, Stalybridge, Cheshire.*

Silicone introductions

AMONG several recently introduced silicone products manufactured by the ICI Nobel Division is a silicone grease, M.494. This grease is claimed to have outstanding electrical qualities making it ideal for protection of insulators against corona discharge, sealing and potting electronic equipment and for lubrication of cables before being drawn through harnesses and conduits. This grease is also intensely water repellent, a characteristic also shared by a new solvent-based product, M.492, although this is primarily intended for treatment of textiles and leather. Other introductions include a silicone resin, DP 115, said to be a very good adhesive and recommended for bonding silicone resin to glass cloth laminates and to metal. A microcellular rubber, DP 137, can be used at temperatures from −80° to +250°C, and a series of four silicone rubbers, E.313, which have high strength and electrical properties are said to be particularly suitable for electrical sleeving. *ICI Ltd., Imperial Chemicals Hse, Millbank, S.W.1.*

Shrouded terminal blocks

A VALUABLE safety feature of a new series of plastics terminal blocks is the addition of an insulating shroud enclosing completely all live parts. The blocks are supplied for two- or three-ways, suitable for 10 A rating. The conductors are held by pinch screws which are themselves shrouded, but the addition of the insulating shroud prevents access to these screws completely. The block may be fixed to a surface and the shroud attached separately to it. *Metway Ltd., Metway Wks, Canning St, Brighton 7.*

Reversing contactor starters

A SERIES of direct-on-line contactor starters for three-phase motors covers in seven sizes the range to 300 h.p. The starters have two mechanically interlocked air-break contactors, which may be used either for reversing duty or for dual speed control of two winding motors. The starters are enclosed in wall-mounting cases. In addition to under-voltage features, they have a common overload unit with three adjustable thermal overloads which are temperature compensated. A single-phase preventor is also included. Control may be by local or remote push-buttons and suitable terminals are provided. The starters comply with the requirements of BS 587 for frequent duty. *Electrical Apparatus Co. Ltd., St. Albans.*

New switchboard instruments

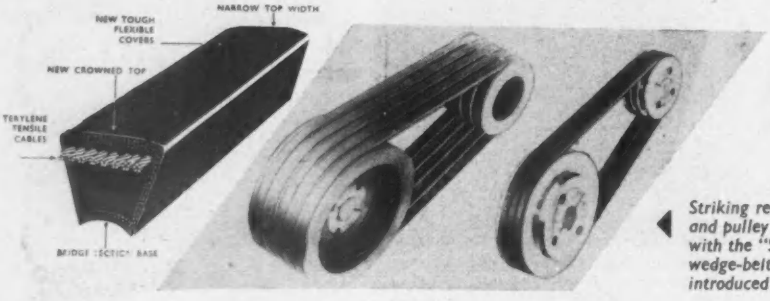
IN designing their new "Crystal" range of switchboard instruments, Measuring Instruments have concentrated on obtaining a clear reading and eliminating reflection. The instruments have a plastics dial, permitting light to enter from almost any direction, and the lower part of the instrument is blanked off to emphasise the scaling. Instruments are available with either moving coil or moving iron movements for a.c. and d.c. and have scale lengths of 2·4, 3·8 and 4·8 in. A 2½ in. edgewise instrument claimed to enable the scale to be accurately read from any angle while avoiding parallax errors has also been introduced. Both these instruments have plastics cases. Another introduction is the adaptation of a switchboard instrument as an on-off controller by using the pointer tip to interrupt a light beam directed on to a photo-transistor. The photo-transistor operates a relay with contacts rated 3 A 200 V a.c. Relays can be fitted to operate with increasing or decreasing deflection of the pointer, or both. The fourth introduction is an hours counter for assessing the life of electrical equipment. The counter is operated by synchronous motor and has an indicating drum which may be calibrated in hours and one-tenths of an hour up to 100,000 hours. *Measuring Instruments (Pullin) Ltd., Acton, W.3.*

Cable cleat aids installation

SIMPLE and quick installation is the principal claim for a range of cleats suitable for one or more cables. The cleats consist of a stirrup, which is intended for hanging from angle iron or similar support, shaped cable supporting plates and a pressure screw. These parts are held together by a pivoted rivet to prevent their becoming lost. The "Pohl clips" are also claimed to be easily adjustable for alterations in cable runs and versions are available for horizontal or vertical mounting. Up to ten cables can be installed under a multi-clip version and extra long supports can be supplied for plastics covered cables. *Herman Pohl, 12-13 Henrietta St, W.C.2.*

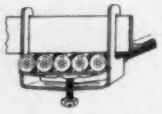
Slimmer, lighter, shorter and cheaper belt drives

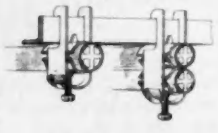
BY taking advantage of the characteristics of modern synthetic materials and by selecting scientifically a belt cross-section to give the most efficient performance, J. H. Fenner have achieved notable space and cost reductions for their "SpacesaVer" belt drive. The "SpacesaVer" wedge-belt drive incorporates terylene cords to bear the load. These are embedded in synthetic rubber by a specially developed bonding technique to ensure that there is no relative movement between the terylene cords and the rubber. It is also claimed that the improved belt cross-section keeps the load-bearing cords most efficiently placed. Only two wedge-belt sections are needed to cover normal drives up to 200 h.p. Belt sizes and combinations for particular drives may be obtained from a comprehensive catalogue reference 135/20/12. In addition to giving great cross-section stability, the rubber synthetic has good heat and oil resistant properties and is sufficiently conducting to prevent a build-up of static charge. It is claimed that reductions in belt cross-section of up to 50% are possible with no loss of belt life. Pulleys designed for use with the new belts have narrow grooves, and modern casting techniques have enabled their weight to be reduced considerably. All the pulleys are fitted with "Taper-lock" bushes, enabling them to be simply fitted without keys or keywaying. By using the new "SpacesaVer" belt drive, typical reductions quoted over the conventional V-belt for a 100 h.p. motor are a reduction in pulley face width of 50%, a reduction in drive weight of 35% and a 26% reduction in list price. For some smaller drives even higher reductions are possible. "SpacesaVer" wedge-belt drives will be available from 1 Sept. this year. *J. H. Fenner and Co. Ltd., Hull.*



Striking reduction in belt and pulley size achieved with the "SpacesaVer" wedge-belt drives soon to be introduced by J. H. Fenner.

Two versions of the "Pohl" cable supporting clips.



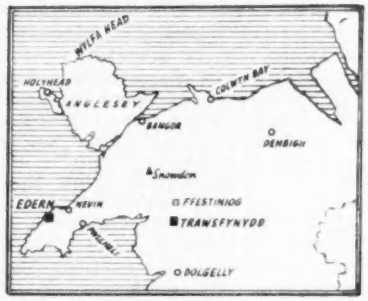


News of the Week

SECOND WELSH NUCLEAR STATION

Site on North Anglesey chosen

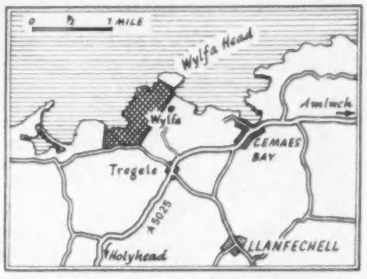
WYLFA, on the north coast of Anglesey, is likely to be the site for a second Welsh nuclear station. This has been decided by the CEGB following investigations at three sites in Anglesey: Wylfa, Carmel and Trefadog, all of which have proved satisfactory. The new announcement displaces Edern in Caernarvonshire for the second nuclear power station. In 1957, when Trawsfynydd was chosen, it was announced that Edern provided a suitable site for a very large nuclear station. However, Wylfa is now thought to be marginally superior to Edern on economic grounds, and also slightly more acceptable from a planning and amenity point of view.



Wylfa in relation to the Trawsfynydd station (under construction) and Edern (postponed)

The recent revision of the nuclear programme means that a station at Wylfa will not be required in the period up to and including 1966. That means that construction could not begin until 1963 at the earliest.

There has been considerable objection to the tentative plan for a station at Edern on amenity grounds. The area involved was one designated as "of outstanding natural beauty." There have been reports that local authorities would have preferred use of the Carmel site in Anglesey to the Wylfa site, but the coast at the latter is rocky and relatively inaccessible, with beaches rarely used. Total population of the three immediately joining parishes has been put at 1,800.



The shaded area shows the proposed nuclear station site. Map based on Ordnance Survey

Scottish Boards to Merge?

THE familiar rumour of a possible merger between the North of Scotland and South of Scotland Electricity Boards is once again current in Scotland. No confirmation or denial has been given and a Scottish Office spokesman said that the suggestion was no more than "speculation." It seems unlikely that any move towards amalgamation lies within the immediate prospect; the dust has not yet settled of Tom Johnston's battle for independence for the hydro board, which he made at the time of setting up the South of Scotland Board. The two areas are wholly different in character and the northern board has also a different task in that it is required to look to the larger task of rehabilitation in the Highlands. There is likely to be opposition from both areas if such a move becomes imminent. On the other hand, the task before the North of Scotland Board is becoming increasingly difficult as its activities extend more and more into the uneconomic.

In recent months, the North of Scotland Board has been criticised on the one hand for embarking on expensive hydro generation schemes, and on the other for failing to make fast enough progress in connecting the more remote villages and crofts in its district.

London Appliance Centres

A.E.I. - Hotpoint . . .

Early in December AEI-Hotpoint Ltd. are to open the Hotpoint Home Centre in London's West End—on the corner of Oxford St and John Prince's St. It will occupy 6,000 sq ft on the ground- and lower-ground floors of a new block of shops and offices adjacent to Oxford Circus. Advice and information on all aspects of home economy and housecraft will be available.

. . . English Electric

The Domestic Appliance Division of the English Electric Co. Ltd., formerly at Queen's House, Kingsway, has just moved to the new building at the corner of Aldwych, to be named English Electric House. Provision is made there for the display of certain appliances, but it is planned to have another showroom elsewhere in London, we understand.

Thorn Electrical acquire Brimar

ONE of Britain's biggest radio and television manufacturers, Thorn Electrical Industries Ltd., has acquired the domestic valve and cathode-ray tube side of Standard Telephones and Cables (a subsidiary of the US International Telephone and Telegraph). STC's "Brimar" valve and tube division becomes part of the Thorn group to supply a major part of Thorn's tube and valve requirements for receivers produced under the Ferguson, HMV, Marconiphone and Philco brand names.

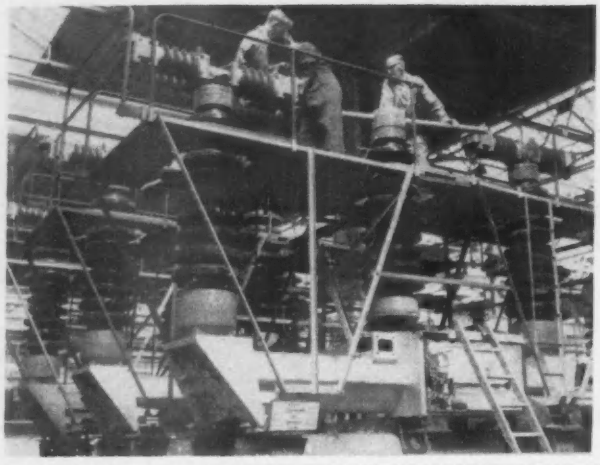
The "special" valve division of STC is not included in the transaction, nor the semiconductor and rectifier division. A new company is to be formed under a name which will include the well-known "Brimar" trade-mark and will continue all the activities previously carried out in this field, Thorn state.

Thorn are taking over two factories, one at Footscray and one at Rochester, involving some 2,000 personnel. A further factory is under construction at Rochester. Thorn have not previously made valves or cathode-ray tubes, although a few years ago there was a report in trade circles that the group were contemplating the manufacture of cathode-ray tubes at competitive prices.

More pay for apprentices

AN all-round pay increase for apprentices in the engineering industry was agreed last week between representatives of the Confederation of Shipbuilding and Engineering Unions and the Engineering and Allied Employers' National Federation.

The increases, operative from Monday, 25 July, are: age 15, by 3s 10d to 51s 4d; 16, by 4s 6d to 62s 3d; 17, by 6s 8d to 74s 8d; 18, by 11s to 103s 3d; 19, by 14s to 122s 1d; and 20, by 17s to 144s 8d. The skilled fitter's time rate is 186s 8d and the adult labourer's rate is 157s 4d.



A 7,500 MVA 150 kV air-blast circuit - breaker for the Gelderland Power Supply Co., Holland, under construction at AEI Switchgear Division's Trafford Park works. Five of the 13 breakers on this contract are for Dodewaard substation, near Arnhem, where some are already installed

Is a substation 'industrial development?'

ON the grounds that the use of the site for industrial purposes would be a substantial departure from the provisions of the town map, Wiltshire County Council have refused permission for the erection of a 33/11 kV transformer substation on land at Dairy Hse Bridge, at Salisbury's city boundary, on the Salisbury-Southampton road. The matter was the subject of a public inquiry recently when Mr D. G. J. Millington, for the Southern Electricity Board, submitted that the substation was not industrial development. Such substations were, in fact, built in residential and rural areas, he argued.

The need for the new substation, estimated to cost £78,000, was explained by Mr W. R. Parsons, engineer of the board's No. 4 sub-area, who pointed out that the only alternative scheme would be to build the substation at the Generating Board's plant in the centre of Salisbury, but this would entail laying underground cables through the city and would cost £136,000. Replying to a question, he agreed it might be possible to site the substation a little closer in towards the city, but only within a quarter-mile radius. It would mean coming towards residential areas, and there was the problem of transformer hum as well as more underground cable work. For the County Council it was maintained that the planning authority were anxious lest approval for the substation led to the area being opened up. Mr G. E. Jagger, area planning officer, said there might be some threat of industrial development extending across the River Bourne; but Mr Millington pointed out that the board were not commercial developers, but suppliers of a public amenity.

PAY CLAIM TALKS

NEGOTIATIONS on the claim for a substantial wage increase for manual workers in the electricity supply industry are to be resumed tomorrow (29 July). This was agreed at last week's meeting of the NJIC. The negotiations are to proceed through a sub-committee.

Metal Cleaning

A NEW name, Metal Cleaning Ltd., has been given to the recently acquired subsidiary of the Castrol group formerly known as De-Corrosion Services (Norwest) Ltd. The company will provide services to clean corroded metals and remove all other forms of metal contamination, using electro-chemical, chemical immersion, and flame and shot-blasting techniques. After cleaning, protective treatment is applied.

The processes can be carried out either on the spot or at the company's works, 2-6 St. John's Rd, Bootle 20.

How good are Russian instruments?

REPORTS that exhibitors at the SIMA exhibition in Russia were "flabbergasted" at the quality of Russian instruments caused some discussion in the House of Commons last week. Suggestions by an MP that Russian equipment was so good that it was awkward to sell the instruments being produced in Britain drew a ministerial reply that between 90% and 95% of the equipment shown at the British exhibition was sold. Although Russian progress was very considerable, British manufacturers were in Mr Maudling's view "doing pretty well too."

Radios from Japan

INCREASED quotas for the import of Japanese-made radios (as we reported last week) were the subject of protests by MP's. However, they were rejected by the President of the Board of Trade, who emphasised the need to maintain a liberal trade policy if Britain was to have the opportunity to export. The quota for transistorised radios from Japan is to be £200,000 in the future, with £100,000 for non-transistorised radio and television sets and another £100,000 for non-transistorised radiograms and gramophones. The £200,000 for Japanese radio imports compared with sales of about £7 million per year for home-produced sets, said Mr Maudling. The tariff of foreign electrical goods generally varied from 10% to 33%, which he considered a fairly reasonable level of protection.

N.I.C. calls for more socket-outlets

MORE socket-outlets are needed for safety than the number recommended in the current Scottish Department for Health Housing Handbook No. 4. The Secretary of State for Scotland has been told this by the Scottish Committee of the NICEIC, who are concerned that buildings are being erected on the basis of these recommendations. The committee hopes that more realistic levels of installation will apply when regulations under the Building (Scotland) Act have been drawn up—but this will not be for at least two years. The action of the Scottish committee is noted in the thirteenth Progress Report of the NICEIC, issued recently. It covers the period between 1 April and 30 June, 1960, during which time 111 applications for enrolment were received, 34 were approved, four rejected and 45 deferred for further inspection. Sixty-one firms were removed from the roll of approved contractors, including 32 in Eire, where the National Inspection Board has decided that the Council should not attempt to operate.

In the technical section of the report it is noticed that there was a marked drop in number of routine inspections carried out during the period reviewed, partly because of holidays, partly because of a substantial increase in the number of new applications.

The inspecting engineers are finding it increasingly necessary to draw attention to the IEE Regulations requiring use of appropriate materials to suit installation operating conditions. There has been trouble in particular with use of polythene-insulated, p.v.c.-sheathed cables in domestic installations in conditions of relatively high temperature. Cases have been met where cable insulation has been melted away, leaving cable cores completely exposed.

Another topic discussed in the technical part of the report is earthing to water mains. Inspecting engineers are finding it increasingly evident that water supply authorities are "very much concerned" with the practice of connecting the main earthing lead for an electrical installation to the incoming water service to the same premises. The NIC advice to contractors is that they should contact the local electricity board to check whether it is possible to connect to the incoming supply sheath or earthing conductor.

Elstree - Finchley 275 kV Line Inquiry

STRONG opposition to the CEGB's proposals for a 275 kV overhead line from Elstree to Finchley and a substation at Mill Hill was voiced at the public inquiry at Hendon last week. Discussions on the route have been going on since 1952, objections being mainly on amenity grounds. But the CEGB were opposed to placing the line underground for economic reasons—it would cost £1,810,000, about 5 times more than for overhead—Mr S. B. R. Cooke pointed out on behalf of the board. If it could not have o.h. lines, the board would have to consider extension of Elstree substation and the laying of cable to Finchley, Marylebone and Wembley, which would cost £98,000, but the board did not consider such expenditure was justified, he said.

Among the objectors were Middlesex and Hertfordshire County Councils, Hendon, Finchley and Harrow Borough Councils, Barnet U.D.C. and Elstree R.D.C., in addition to several ratepayers', residents', and Green Belt associations.

The inquiry was concluded late last Friday evening.

The inquiry was conducted by Mr A. H. F. Linton, deputy chief engineering inspector, Ministry of Power, and Mr. H. W. Lovell, senior inspector, Ministry of Housing and Local Government, who are to visit the areas involved in the dispute.

Temco Battle ended

THE battle for control of the business of the Telephone Manufacturing Co. is all over bar the shouting—Pye Ltd. have now obtained over 50% of the shares and are offering 19 Pye Ordinary for every 20 of TMC. The other contestants in the struggle, the consortium of seven firms, are believed to have secured around 15% of the capital. Whether they will retain that holding is not yet clear.

Mr C. O. Stanley, chairman of Pye, has repeated his attacks on the "telephone ring," but can he now do anything about TMC's participation therein?

Replying last week to the six points put forward by the consortium in defence of the bulk supply arrangements, he stressed that standardisation could be achieved without destroying competition and that co-operative research, while desirable in industry, should not be established as a closed shop. Despite Post Office expenditure of £96 million in a year, the UK was still only ninth in world telephone development, with exports at less than 20%.

Meanwhile, he has submitted a memorandum to the President of the Board of Trade on how telephone exports could be increased. The "closed shop in telephone manufacture and design should be ended," he suggests, and the GPO should stop working through a trade association (TEMA) which restrict membership to the present ring. The Government should set up a telecommunications export board and a telecommunications training school. There must be "an end to cartel agreements and market carve-ups with foreign associates, which limit exports."

Summing up, Mr Stanley said: "The problem is for politicians to solve, and it must be cleared on the floor of the House of Commons."

Details of the bulk purchase agreements operated by the Post Office were given in a Parliamentary answer last Thursday. The PO usually works through five-year agreements, undertaking during that time to place substantially all its orders for particular products with contractors who are party to the agreements. The group of contractors nominate one of their members to undertake each individual order. Patents held by the contractors are pooled, and all receive the same price rates, basic prices being fixed for the term of the agreement. These prices are calculated on a basis of cost investigations at works selected by the Post Office. The PO reserves the right to manufacture equipment in its own factories, to contract with anyone for apparatus embodying some new principle or method of working intended for experimental purposes and the right to enter into contracts outside the group if the PMG thinks this would be in the interest of export trade. There is a general right for the PO to place about 10% of its orders outside the group with whom the agreement is made.

Heater rights acquired

PARKINSON Cowan Appliances Ltd. of Stechford, Birmingham, one of the Parkinson Cowan subsidiaries, have taken over the manufacturing and distribution rights of the range of electric fan-convector heaters previously made and marketed by P. W. Baker & Sons (Sales) Ltd. of Chichester. The range includes the "Mayhurst," "Elfin" and "Universal" heaters.

MORE TAKE-OVER BIDS

ELLIOTT Automation Ltd have made a merger approach to the Rheostatic Co. Ltd., for whose £150,000 Preference and £986,600 Ordinary capital an offer is to be made. The Rheostatic directors have indicated that a further announcement is soon to be made. Meanwhile, shareholders are advised not to sell.

Through its subsidiary, South Wales Switchgear Ltd., Aberdare Holdings Ltd. have purchased the minority interest in Treforest Electrical Services Ltd., which thus becomes a wholly owned subsidiary. Treforest Electrical Services have two factories in the Aberbargoed area, making l.t. switchgear and fusegear and associated equipment. Aberdare Holdings have also acquired the whole of the share capital of Neptune Brass and Aluminium Co Ltd., makers of castings.

Allied Ironfounders have made a £1,850,000 share exchange offer for Bilston Foundries Ltd. They offer two £1 AI shares for every 15 Bilston 2s shares.

OFFICIAL PUBLICATIONS

Select Committee on Nationalised Industries. British Railways Report from HMSO, 5s 6d (see page 146).

European Organisation for Nuclear Research. Report for 1959.

Horticultural Machinery Leaflet No. 1. Glasshouse heating systems. HMSO, 6d.

BS amendment slips: BS 171, Power transformers, PD 3804; BS 1259, Intrinsically safe electrical apparatus and circuits for use in explosive atmospheres, PD 3788; BS 2076, Thermosetting synthetic-resin bonded-paper insulating sheets for use at radio frequencies, PD 3762; BS 2852, Rating and testing refrigerated air-conditioning units, PD 3816; BS 2899, Vulcanised rubber insulation and sheath (including Polychloroprene) of electric cables, PD 3797; BS 2929, Safety colours for use in industry, PD 3760; BS 3053, Open and closed refrigerated display cabinets, PD 3770; BS 3058, Varnish-bonded glass-braided copper conductors, Part 2 Rectangular conductors, PD 3759.

The second of the Son et Lumiere spectacles this year was switched on at Norwich Cathedral on 22 July. The story in sound is the history of the cathedral over the centuries in a script by John Mortimer. Lighting, by "Atlas," incorporates the new Aurama System developed by the company in which some 250 prearranged lighting effects are taped and sequenced by control signals from small "perforations" in the sound tape between the tracks. Nightly presentations will continue until 17 Sept.

How profitable is rail electrification?

MODERNISATION of British Railways, and electrification in particular, receives close attention in a House of Commons Select Committee on Nationalised Industries' Report published last week. The general tone of the report is highly critical of the British Transport Commission, particularly in respect of its financial estimates. It complains, for example, that when the London Midland electrification scheme was prepared, BTC did not inform the Ministry of Transport what would have been the cost of dieselisation instead of electrification. Moreover, on figures quoted, it seems that the scheme may pay only 5% on money invested in it, although this figure has been increased more recently as a result of new calculations. The cost of the scheme, first estimated at something over £75 million, is now put at £161 million.

However, the select committee say they "are not aware of any considerations which would justify the abandonment of the London Midland electrification at this stage." The right policy is thought to be completion of the scheme as soon as possible. On modernisation in general, the committee charges that the BTC choose the right priorities, but failed for one reason or another fully to implement them.

The report notes the "terrific impact" that electrification and dieselisation have made on income from lines where they have been introduced. So far as electrification schemes are concerned, increases in revenue have invariably proved to be more than expected. This despite a difficulty with bogies for electric rolling stock which has meant, according to the report, that the new electric stock has not been as good as possible.

Shortage of technical staff is a limiting factor in railway work. The salaries the BTC offers to graduates is estimated to be about equal to the middle range of industry, although top salaries in the middle range were about 15% below average. Wastage of engineering graduates has been as high as 15%, and BTC acknowledge that they are open to criticism in not maintaining a high enough proportion of graduate engineers.

The report notes that the commission has done little to provide scholarships at universities and the like. Although the BTC claim that recruitment of electrical engineers has been reasonably satisfactory, they had a professional staff of only 277 in 1959, compared with an estimated requirement of 337. The greatest difficulty has been with signal engineers, which is a principal factor in determining the speed of modernisation work. The select committee note with concern that, despite such difficulties, no records are kept centrally of highly qualified engineers who are in the commission's employ.

TRADE WITH CHINA

SHORTAGE of sterling in Chinese hands is the main limitation of expansion of trade with China. That is the opinion of Mr R. Maudling, President of the Board of Trade, expressed in answering a House of Commons question last week. He noted that imports and exports for the first five months of this year were much greater than last year, and denied that there was any pressure from US sources to alter the policy of expanding trade.

Distribution Census in 1962

A CENSUS of distribution covering trade done in 1961 is to be taken in 1962, the Board of Trade announced this week. The census will cover retail trade (except those selling coal and other solid fuels, timber, building materials, agricultural supplies, motor vehicles, petrol and oil); businesses engaged in hiring out or repairing consumer goods; and certain other retail services (but not wholesaling).

S.O.S. Appliance Hire Rates Up

INCREASED hire rates for cookers, water heaters and other appliances are to be charged by the South of Scotland Electricity Board from the first meter reading taken after Sept. 30. The new rates have been approved by the Consultative Council.

In a circular sent to consumers by the Board "substantial increases in the costs of both labour and materials" are blamed for the present increase in hire rates which have been operating for a number of years without change.

New quarterly hire charges include: two-plate cooker (solid boiling plate) 14s 6d; three-plate cooker (radiant boiling plate) 19s; wash-boiler 4s; immersion heater (including plumber work) 7s.

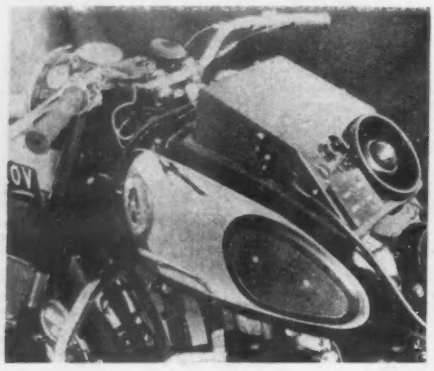
International Standards

A RECENT meeting of the International Commission on Rules for the Approval of Electrical Equipment (CEE) included conduits and fittings, appliance couplers, and switches amongst its work, according to *BSI News*. An important development in the conduit field was a proposal to adopt an ISO metric thread for screwed conduit, replacing the PG thread and the BS 31 thread used in some continental countries. A majority of member nations supported this proposal. A draft for appliance couplers was agreed without major comment, but the UK and Denmark indicated that they did not intend to adopt the proposed 10 amp CEE non-reversible connector for hot conditions. Good progress was made with drafting a specification for switches for building into appliances and a further meeting is to be held in London next September.

World Power Conference Plans

PROVISIONAL plans for the plenary meeting of the World Power Conference to be held in Melbourne, Australia, from 20 to 26 Oct., 1962, have been issued by the WPC secretariat. The theme to be developed is "The Changing Pattern of Power," and arrangements for preparation of papers to be presented by the British National Committee have been placed in the hands of a special papers committee under the chairmanship of Sir Josiah Eccles. Suggestions as to papers should be sent to the secretary of the British National Committee, World Power Conference, 201 Grand Buildings, Trafalgar Sq. Within the main theme, five divisions are planned, dealing with energy resources, production and amelioration of primary sources of energy, transformation of primary to secondary energy and its transportation, use of energy, and economic evaluation of alternative energy sources. Possible development of these subjects is discussed at length in a technical programme prepared by the Australian National Committee.

At a recent meeting of the international executive committee of the WPC, a resolution was adopted expressing concern that a third international nuclear energy conference might be convened by the UN in 1962, clashing with the WPC meeting.



SPEED-COPS KEEP IN TOUCH

Motor-cycle police can transmit and receive messages at speeds up to 70 m.p.h. with a two-way v.h.f. f.m. radio now being supplied to the Lancashire Police by GEC Ltd. The receiver-transmitter is housed in two units weighing 31 lb, mounted on the petrol tank and rear carrier. Among the unique features are a special microphone earpiece which slips under a crash helmet and is linked to the tank unit by a magnetic clip. A sudden jerk serves to disconnect the clip. To enable messages to be transmitted and received in safety at high speed, an operating button is mounted on the motor-cycle hand grip. Using transistors, current consumption on a 6 V battery is only 0.8 A when receiving. Range is between 45 and 90 miles, depending on the terrain.

EQUIPMENT ORDERS

Switchgear

SWITCHGEAR for the CEGB's experimental 380 kV transmission line between High Marnham and Monk Fryston (to which we referred on 16 June) has been ordered from the AEI Switchgear Division. The board's first order for 380 kV switchgear, it will include 380 kV isolators and earth switches, substation connections and protective gear at High Marnham.

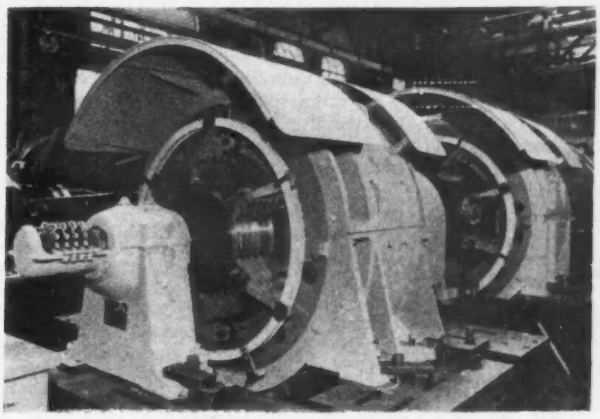
AEI Switchgear Division have also received an order from the CEGB for a new switching station at Brinsworth, near Sheffield, to serve the new steelworks projects in the area. For this, seven 275kV lenticular tank o.c.b.'s, 20 isolating switches, 6 earthing switches are being supplied in addition to control and relay panels and connection material for the outdoor equipment.

Rectifiers

WHAT is probably the largest silicon rectifier equipment to be made in Britain, rated at 50,000 A at 200 V, is now being manufactured at the Chippenham works of Westinghouse Brake and Signal Co. Ltd. for Murgatroy's Salt and Chemical Co. Ltd. at Sandbach. This equipment will be used for the production of chlorine and caustic soda by the electrolysis of brine derived from underground salt beds.

The silicon rectifier diodes will be mounted on water-cooled busbars in four separate cubicles. The transformers stepping down from 11 kV and the tap changing equipment and bridging regulators to provide continuity of current control are being supplied by the General Electric Co.

Westinghouse have also secured another order for a smaller silicon rectifier equipment rated at 25,000 A at 40 V for chlorine production for water purification in Kuwait, where the air temperature may reach 126°F. The electrolytic cells and other chemical equipment are here provided by Krebs, of Switzerland.



The main and auxiliary plant for the Mersey Docks and Harbour Board's new 2,200 ton grab hopper dredger is being supplied by the General Electric Co. Ltd. Here, one of three tandem generating sets, rated at 500V 940 kW and 460/230 V 450 kW, respectively, is being tested at the Witton Works

No Panic about Export Drive

THERE was no panic about Britain's export drive, Mr Harmar Nicholls, Parliamentary Secretary to the Ministry of Works, told the Wolverhampton Chamber of Commerce, supported by the Dudley and Walsall chambers, last week. Since last October the index of production had risen from 117 to 121, unemployment had fallen, and industry's capital investment showed a 14% increase on last year.

But, although Britain had done well in the export markets, other countries seemed to have done better. In the first quarter of the year UK exports had increased 17% compared with the corresponding period in 1959, but Germany's had increased 30%, Belgium's 33%, France's 54%, Italy's 56% and Sweden's 31%.

Members of the chambers of commerce appealed for more incentives to firms responding to the new export drive, in the form of direct financial aid or special tax reliefs. The Government could contribute to the expenses of the small businessman travelling abroad in search of export trade, it was suggested, and credit facilities could be made simpler.

Although cautious in his views about incentives because rival countries might treat them as Government subsidies, Mr Nicholls undertook to discuss the suggestions with the Board of Trade.

Cheap schools rate refused

A SUGGESTION by Staffordshire County Council that council properties should be charged for electricity at a special rate—a low unit price and a combined fixed charge based on m.d. assessment—was rejected by the area consultative council last week. The County Council expressed the view that a vast number of educational properties did not encroach on the Midlands Electricity Board's peak periods and, therefore, should be charged a special rate. It was pointed out that similar requests from old-age pensioners for favourable treatment had been turned down.

Hobday's in Liquidation

Losses sustained on imported refrigerators were largely responsible for the present difficulties on Hobday Bros. Ltd., wholesalers, it was stated at meetings on Tuesday last, when the shareholders and creditors approved a resolution for voluntary winding-up of the company. Mr Sunderland, C.A., was appointed liquidator.

It was stated that unsecured trade creditors were owed £235,573, in addition to a bank overdraft of £28,522, and total debt was £275,807.

Claims of preferential creditors amounted to £153,625, mainly of the Customs and Excise in respect of purchase tax. Assets were listed at a book value of £451,521.

The company had been established since 1915, and at the beginning of this year Mr Christopher Hobday had taken over the radio and t.v. side of the business and places at Sheffield and Leigh-on-Sea. It was stated that operations in the year ended 28 Feb. last resulted in a net loss of £45,259, out of total sales of £1,750,896, and in the previous year a profit of £1,876 was made, but losses were sustained in earlier years.

Operations in the period from 1 March last to 30 June resulted in a net loss, before tax, of £104,090, from a sales turnover of £1,808,516, it was stated.

£1 million development for Somerset

A FURTHER £1 million will be spent on development of electricity services in Somerset this year announced Mr A. N. Irens, chairman of the South Western EB, on Wednesday of last week. This follows a £1½ million scheme carried through last year during which nearly 5,000 consumers were connected for the first time. These included 400 farms and 2,000 other rural properties requiring 200 miles of mains and nearly 400 new substations; 85% of the rural premises in the south west now have electricity and this year's programme will bring supplies to a further 2,000.

Mr Irens was speaking at the opening of the Nailsea £43,000 substation, which will improve supplies in both the Nailsea and Backwell areas. The substation capacity will be raised from the initial 3 MW to 12 MW during the next 15 years to meet the estimated growth of industrial and residential demand in the area.

Electrical Gardening

A NEWLY revised edition of the *Electricity in Your Garden* booklet has just been issued by EDA. Within its 48 pages it provides good advice on the various applications of electricity and some of the types of equipment available. The booklet is obtainable from EDA free of charge.

Non-destructive Testing Conference

NON-DESTRUCTIVE testing in electrical engineering is to be the subject of a conference held at the IEE building from 8 to 10 Nov., 1961. The conference is being organised by the Measurements and Control section of the IEE in association with the British National Committee on Non-Destructive Testing, and will have the theme, "How best may the electrical engineer test the quality and endurance of his materials and structures?" The conference is to concentrate on electrical methods of testing; better-known methods of examination such as those used for detection of defects in materials and structures for civil and mechanical engineering will in general be excluded.

Proposals for papers for presentation to the conference are invited by the organising committee, preferably in the form of résumés sent in triplicate to the Secretary, IEE as soon as possible, and not later than 31 May next. A list of suggested subjects and other information is available. Papers should not exceed 8,500 words in length, and short papers of 500 to 1,000 words will also be welcomed. During the conference, it is hoped to accord facilities to authors who wish to display small items of equipment connected with the presentation of their papers.

LEA HALL COLLIERY OPENED

LAST week an important stage in a £43·5 million development programme for the coal and electricity industry was completed with the opening of Lea Hall colliery. When the colliery is in full production in 1965, it is anticipated that production will reach a target figure of 1,500,000 tons per year. About 60% to 70% of this output will eventually be consumed in the new Rugeley power station which the CEGB are now constructing on a site adjacent to the colliery.

The decision to construct the station virtually at the side of the colliery will allow coal to be taken direct to the coal-handling plant by twin-belt conveyors. Substantial cost savings for road access, storage hoppers and other facilities will, therefore, be possible, although a coal-store area of 23 acres will be provided to ensure continuity of supply.

Lea Hall colliery is situated in the north east of the famous Cannock Chase coalfield and its tonnage will eventually replace that of older pits now being worked out.

Eventually, the mine will have nearly 23 miles of underground roadways feeding two shafts, and at depths of 880 and 1,200 ft. Underground transport will be by 65 h.p. battery driven locomotives drawing specially designed cars for coal, men and materials.

The cars will be hauled to the surface in 58 seconds by electric mine winders built by GEC. These winders are driven by motors rated 2,100 h.p. 3·3 kV, 3-phase and having an automatic control system. Coal will eventually be raised by two hoists in the No. 1 shaft at the rate of 600 tons per hour.

Electricity supplies for the colliery are drawn from the grid at 11 kV with provision for a demand of 15 MW.

Rugeley power station will have five Parsons 120 MW sets, of which the first is scheduled for commissioning in November this year. The turbine steam conditions will be 1,500 lb/sq in., 1,000°F with reheat. Because of the water paucity in the Trent Valley the station will have five cooling towers. One of these towers is particularly worthy of note because of its immense size. It will be 325 ft diameter at the base, 350 ft high and will include, for the first time, a closed-circuit cooling system to prevent loss by evaporation. The station will consume nearly 250 tons of coal per hour when it is fully commissioned, derived from the colliery preparation plant. Ash from the station will be pumped to a 75-acre disposal area where it will compensate for subsidence caused by coal extraction underneath.

Industrial Art Competition

DETAILS have now been announced of the 1960 Industrial Art Bursaries Competition sponsored by the Royal Society of Arts. The prizes this year amount to the record sum of £5,375 (£1,000 more than in 1959) and take the form of travelling bursaries, in most cases of £150 each.

The bursaries are offered for the best designs of a number of industrial products, including domestic electrical appliances, electric light fittings and laminated plastics.

The competition is open to students attending an art, architectural or technical college, and to other young designers who intend to take up industrial designing as a career. Closing date is 10 Oct. Details from the Society at John Adam St, W.C.2.

New B.S.I. Work

CABLES figure prominently in the latest list of new work started by BSI. New standards are planned to deal with butyl-rubber insulated cables with a heat-resisting fibre layer and with terminations for mineral-insulated cables. Prominent in the list of standards selected for revision is BS 480: Paper-insulated cables. The purpose of the revision in this case is to introduce tests on the paper insulation as agreed in the Commonwealth Standards Conference in 1959, to amend some other test requirements and to recognise aluminium conductors for such cables. Also in the revision list are enamelled copper conductors and cotton-covered copper conductors, the existing BS numbers being 156 Pt 1, 1791 Pt 1, 1844 Pt 1, and 2084.

Of fringe interest to the electrical industry is a planned revision of the code for sampling and analysing flue gases, and preparation of a new standard on safety requirements for children's toys.

A draft standard for p.v.c.-covered conductors for o.h. power lines is currently being circulated for comment, and so are draft standards on cotton-covered conductors Pt 1, round wire; and Pt 3, round wire, metric units.

M.o.W. Contractors List Revision

THE Ministry of Works is to revise its procedure for listing possible contractors for its constructional work. A note will be circulated to contractors in September explaining how companies of suitable standing may get on to the Ministry's approved list from which firms are selected for invitation to tender; at the same time it will be made clear that very small firms employing not more than five men are not encouraged to apply, as the number of jobs they could do would be very limited.

Companies not yet on the list will be invited to apply and, if they meet the standards of the approved list, they will be transferred to it. The present approved list contains the names of some 17,500 contractors.

£12m Transatlantic 'phone link planned

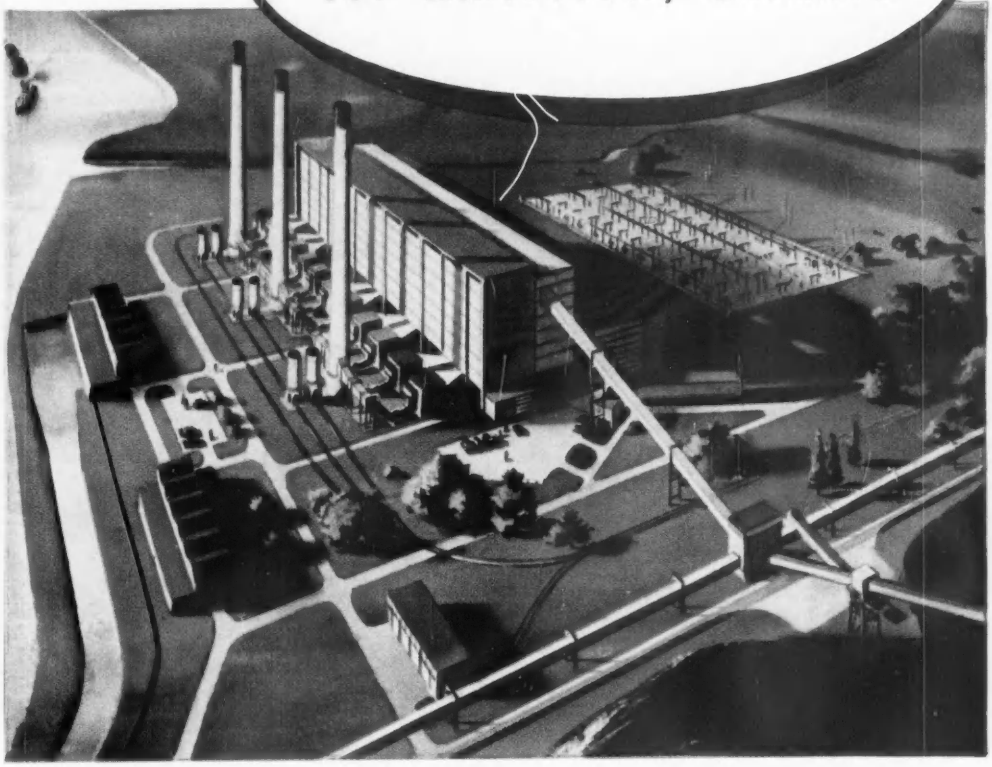
A NEW transatlantic telephone cable, said to be the biggest oceanic cable yet, is to come into operation in 1963. It will carry 128 telephone circuits between the UK and the USA to accommodate the increasing telephone traffic between the two countries.

The project is the result of an agreement between the British Post Office and the American Telephone and Telegraph Co., which will need to be approved by a resolution of the House of Commons before it can become effective.

Total length of the cable will be about 3,400 nautical miles. It will be of light-weight type, using polythene insulation without external armouring, with an overall diameter of about 1¼ in. A single cable will be used to carry speech (and radio programme material, but not television signals) in both directions. Some 180 repeaters designed by Bell Telephone Laboratories will be required.

Cable and Wireless Ltd. will provide the UK share in two other cable projects to link the UK to Canada (1961) and across the Pacific between Canada and Australia (1963/4).

Two 300 MW sets for Lakeview, Ontario



From an original drawing supplied by the Hydro Electric Power Commission of Ontario

THIS artist's impression shows the Lakeview Generating Station now being built beside Lake Ontario. With its planned capacity of 1,800 MW, it will be one of the world's largest thermal-electric plants. Two 300 MW turbine-generators have been ordered from AEI and the first will be installed in 1963. These generating sets, like all AEI equipment, will incorporate advanced design based on long experience.

The AEI turbo-generators for Lakeview will have hydrogen-cooled rotors, and the system of water cooling of stator windings first developed by AEI engineers. The four-cylinder single-axis turbines will operate at steam inlet conditions of 2,350 psig and 1,000°F, with reheat steam at 1,000°F.

For further details, write to AEI Turbine-Generator Division, Trafford Park, Manchester 17, or to your local AEI Office

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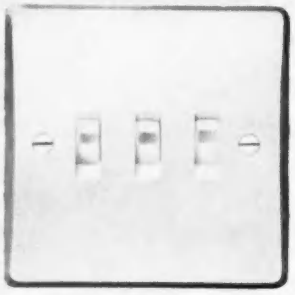
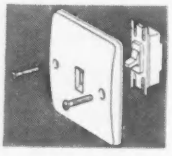
ARCHITRAVE SWITCH ASSEMBLY

PLASTER DEPTH SWITCH ASSEMBLY



Take either a 'Mutac Clipper' plaster depth or architrave switch plate and select the required switch, bell push or pilot light. Simply press home the spring clip with a small screwdriver and a fixed plate assembly is ready for installation. Available in 1, 2 or 3 gang for plaster depth and 1 and 2 gang for architrave. 'Mutac Clipper' switch assemblies will cut installation costs and save time as additions and alterations can be made with the minimum of effort.



G.E.C. INSTALLATION EQUIPMENT GROUP

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

SWITCH AND FUSE GEAR
H.R.C. FUSES
OVERHEAD BUSBARS
RISING MAINS
CONDUIT
PIRELLI GENERAL CABLE
CABLE TRUNKING
UNDER-FLOOR CABLE DUCTS
ELECTRIC WIRING ACCESSORIES
BELLS

Cable ship fire

MOST probable cause of the blaze which destroyed the British cable ship *Ocean Layer* in June, 1959, was the placing of an electric stove, unconnected but still hot, under a lower bunk of one of the firemen's cabins. That is stated in the report of the inquiry, whose findings were announced in London last Thursday, by Mr J. V. Naisby, Q.C., wreck commissioner. But the Court of Inquiry was unable to allocate wrongful act or default to any particular person or persons in respect either of the cause of the fire or of its spread.

The *Ocean Layer* was abandoned without loss of life.

E.R.A. Progress

NEW work undertaken by the Electrical Research Association recently includes studies on the short-circuit rating of plastics-insulated cables, according to *Co-operative Electrical Research* for July. The July number of this ERA journal also notes plans for initiating a number of special researches of interest to manufacturers of high power transformers, such work being carried out on a basis of special financial arrangements. Articles in the July number include notes on early ERA work on air-blast circuit-breakers and on investigations into the effect of wind.

Line approved

THE Minister of Power has allowed the appeal of the CEGB to erect an overhead transmission line from Littleborough to Stalybridge and on to Manchester and Stockport. The matter was the subject of a public inquiry.

In his notification to this effect to Milnrow Council, the Minister states the decision was taken after careful consideration of the inspector's report, but "with considerable reluctance in view of the inevitable loss of amenity involved."

Sayings OF THE WEEK

"Without wishing to enter the resale price maintenance controversy, I submit that its proposed abolition would not be an unalloyed blessing for the consumer, retailer, wholesaler or manufacturer." . . . SIR LESLIE GAMAGE, chairman, General Electric Co. Ltd.

"The CPRE in fact, and despite statements to the contrary, has never asked for the main grid lines to be put underground." . . . Annual report of the Council for the Preservation of Rural England.

"I don't intend to have my desk littered with papers for my decision. If people cannot make decisions lower down themselves, then they are the wrong people." . . . MR ALFRED ROBENS, on his future chairmanship of the National Coal Board.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, July 26

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	251½	−3½
" (3 months)	246½	−1
LEAD, refined pig, 99·97% purity (cash)	71½	+½
" (3 months)	71⅛	—
TIN, refined, min. 99·75% purity (settlement) ...	818½	+5
(3 months)	818½	+7½
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4 x 4 x 54")	193½	—
BRASS Strip 63/37	218½	−1½
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	90½	+½
" (3 months)	89½	−½
RUBBER, per lb.		
No. 1, R.S.S. spot	29½d	−⅛d
c.i.f. basis, ports, Oct. ...	30½d	−1⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 x 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	—
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

C.P.R.E. claims on the surplus

ELECTRICITY is still a subject that causes us much concern, said Mr G. Langley-Taylor, the chairman, at last week's annual meeting of the Council for the Preservation of Rural England—and the extent of the section of the annual report concerned with disputes with electricity boards backs up that judgment. It is mainly transmission and distribution line siting that is in dispute, although power station siting receives some attention.

During the last year the Council have made suggestions that some of the financial surplus earned by the supply industry should be used to pay for undergrounding of distribution schemes in the interests of natural beauty; but the report says that "the CPRE in fact, and despite statements to the contrary, has never asked for the main grid lines to be put underground."

However, currently they are examining breakdown cost figures for the cost of undergrounding 132 kV and 275 kV lines, so that they are in a position to reply convincingly to requests received that there should be undergrounding of such lines.

Grid lines in Lancashire have especially concerned the Council, and they have given renewed attention to the Kent lines, without securing any major revision of plans. So far as distribution lines are concerned, the NWEB is commended as being "most co-operative," but its willingness to underground is compared unfavourably with that of the pre-nationalisation undertakings. MANWEB are "not so co-operative in the alteration of their proposed overhead routes" and have not agreed to the laying of any line underground for amenity reasons. Specific judgment of other boards is not attempted.

So far as power stations are concerned, CPRE has decided to accept West Burton in Notts, but to object especially strenuously to Ratcliffe-on-Soar, and also to Holme Pierrepont and Cottam. In this it is supporting the county council.

R.P.M. Inquiry Queries

NEARLY 8,000 questionnaires have been distributed by the Board of Trade in the inquiry into what manufacturers, wholesalers and retailers think about resale price maintenance. Answers to the questionnaires have been asked for by 17 Sept. next, it was stated in the House of Commons last week. Some MP's suggested that the answers might be misleading because of misunderstandings about the questions. The official view is that the questions have been discussed at length with trade associations and that what is being sought is specific considerations which lead an individual firm to adopt, or refrain from adopting, RPM. (Meteor comments on the questionnaire on page 119).

News in Brief

AEI Lamp and Lighting Ltd. have been granted the Royal Warrant of Appointment as suppliers of electric lamps to H.M. Queen Elizabeth the Queen Mother.

Ipswich and District Electrical Association proposes to hold its ladies' ball at the Royal Hotel, Clacton-on-Sea, on 4 Nov., 1960, and the annual dinner at the Great White Horse Hotel, Ipswich, on 3 Feb., 1961.

English Electric Co. Ltd. are to supply diesel-electric propulsion equipment for New Zealand's first railway ferry to operate across Cook Strait.

In September half the area of the lower ground floor of the Design Centre, Haymarket, will be devoted to an exhibition of various methods of home heating.

Simplex Electric Co. Ltd. are arranging a display by mobile exhibition coach of their new ranges of Star switchgear and S and S automatic control gear, starting at Manchester on 1 Aug., and ending in the Alperton area in October.

The match between the Birmingham Electrical Golfing Society and the Electrical Industries' Club will take place on 31 Aug. at Frilford Heath.

Company Activities

CERTAINLY the trend of information now coming in from Industry suggests that the equity market has a firm base to support the return of optimism that was in evidence last week. Still there is the worry over exports, key to our whole economic problem.

Then, Wall Street wears a worried look. Industrial production in the United States is falling back, the steel industry is working at only 50% of capacity and unemployment is creeping upward. It would go hard for Europe—and that includes us—if the US had to decide to cut down its imports. Moreover, many stock-market operators over here take their cue from Wall Street and the American business scene. Both these factors, our export problem and the unsettled look of Wall Street will act as brakes upon share values in London in the immediate future. Even so, they will be hard put to operate against the buoyancy of the continuing capital goods boom and the continuing high level of Retail Trade. In the first five months of this year deliveries by the engineering industries were nearly 10% higher than a year earlier while the volume of orders on hand at the end of May is provisionally estimated by the Board of Trade to have been 12% above the level at the beginning of the year. And the same source estimates that the value of retail sales in June (albeit a changed demand pattern) at 4% above the level of a year ago. These, then, were the conflicting forces market men were evaluating last week. The result: a rise in the *Financial Times* industrial ordinary share index from 311·3 to 314·8.

Electrical shares, however, displayed reluctance to score over any wide front. Most movements were, in fact, responses to particular items of news. Thus, Pye and Telephone Manufacturing moved within narrow limits according to the "state of the parties." By last Thursday it was known that Pye had bought up over half of Temco's £900,000 capital at an average price per share of 15s 8d. Subsequently, an offer of 19 Pye 5/- Ordinary shares, ex the 15% dividend for the year to 31 March, for every 20 Temco Ordinary shares was posted.

Elsewhere in the electrical market, the results of GEC lifted the £1 Ordinary shares no more than 1½ to 36s 1½d before slipping back to 35s. No excitement was occasioned by the 13% rise in before-tax profits to £4·81 million. Although this was achieved on sales of £117 million, 8·2% higher than in the pervious period. The no more than maintained total dividend of 10% and the further need to put aside £500,000 (£250,000 last time) against the outcome of the Hunterston atomic power contract and with no idea of how much more will be required in the future to set off against this venture has naturally not encouraged much enthusiasm for the shares. None the less, with earnings on the equity now around 19% (against 14%)—thus a cover of 1·9 times for the ordinary dividend—and the dividend yield around 5·7% the shares do not look unattractive for holding over the longer term. Thorn Electrical, on the announcement that it is to make its own cathode ray tubes, jumped 1s 9d to 48s 3d, while Rheostatic, on the bid from Elliott-Automation, spurted 2s 6d to 21s.

Elliott's, although down to a 1·9% dividend yield basis, will make its followers small fortunes in the years ahead. No share collection should be without them.—*From our City Correspondent.*

Allied Ironfounders Ltd.

In addition to the newly introduced refrigerator, this concern has further new products in the domestic appliance field coming on to the market over the next few months to build up the new Electrical Appliance Division. Mr G. S. Steven, the chairman, has announced.

Colvern Ltd.

The order book is in a healthy state and trade continues at the satisfactory level of the year ended 31 March last, Mr L. A. Reddall, the chairman, reports. Work has commenced on the factory extensions at Spring Gardens, a project which will absorb about £230,000 of liquid assets. The new building should be ready for occupation in about 12 months.

East African Power and Lighting Co.

For 1959 the group profit increased to £987,143, compared with £830,553 for the previous year. Dividend is also increased by 2% to 10% with a final of 7%. Taxation charge this time is £66,873 (*£61,385*).

General Electric Co. Ltd.

Group profits for the year to 31 March increased by over £500,000. The total, before tax, is £4,813,173 compared with £4,249,180 for the previous period. Dividend is unchanged at 10% with a final again of 7%. After taxation charge of £1,787,115 (*£1,569,168*) the net profit attributable to the holding company is £2,322,135 (*£1,983,049*). In addition, £390,868 net income relating to previous years has been brought into the group profit and loss account, compared with nil the previous year. The directors state that it is still not possible at this stage to make any accurate forecast of the financial outcome of the Hunterston nuclear power contract. The initial costs and research expenditure to date have been written off and, in addition, it has been considered prudent to provide a further £500,000 out of the profits of the year—for which provision has been made in the figures given. Turnover for the year, at £117 million, was a record and the current year was started with a £138 million order book, £5 million more than a year earlier. But Sir Leslie Gamage, chairman, warns that selling prices are still too low, particularly in lamps and cables. The domestic refrigerator export business, which had been built up to a considerable volume, has declined substantially, chiefly due to attacks by German and Italian firms. On the current year's prospects he stresses that the Government's measures to combat inflation means that hopes of immediate expansion in the domestic field will be frustrated. But by trimming expenditure and increasing sales he hopes that the company will be able to maintain, if not improve on, the results of last year.

Hackbridge and Hewittic Electric

This company (now the subject of a proposed merger with Switchgear and Cowans) has an excellent order book and the means of manufacture to make the current year another successful one, Mr A. M. Browne, the chairman, reports. In the past year the group made another stride forward in the construction of larger transformers—two 180 MVA units have been supplied—and it is hoped that there will soon be an opportunity to obtain orders for still larger units.

Muirhead and Co. Ltd.

Arrangements have been made for placing of 5s Ordinary shares of this old-established electrical instrument company. Capital consists of 3,259,560 Ordinary 5s shares. 977,868 shares (30% of the issued capital) have been placed at 12s 3d a share. The directors expect profit for the year ending 30 Sept. next to be not less than £321,515, in which case they propose to pay an interim of 2½% in Oct. and a final of 7½% next March. Dealings in the shares are expected to commence today.

Radio and Allied (Holdings) Ltd.

Although the group net profit, after tax, of this Sobell and McMichael concern rose from £617,683 to £655,107 for the year to 30 April last, the dividend is increased by 7½% to a total of 30%. The final dividend is 22½%.

Watsham's Ltd.

After taxation charge of £35,293 (*£33,150*), group net profit for the year to 31 March last is down to £38,612, compared with £41,289 for the previous year. Dividend is maintained at 15%.

Dividends Declared

Cable and Wireless (Holdings). Second interim of 1½d per share on increased capital.

Mather and Platt. Interim 3% (*same*).

R. B. Pullin and Co. Interim 5% (*same*) but on larger capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

28 July—Cuckfield U.D.C. Erection of 23 octagonal steel lighting columns, fixing and wiring of 23 3/80 W fluorescent lanterns complete with control gear.—See 14 July issue.

28 July—Droitwich B.C. Supply and erection of 55 30 ft steel columns with 200 W sodium lamps/lanterns/gear and wiring plus the dismantling of 55 existing points.—Advertised 14 July issue.

28 July—Eston U.D.C. Supply and erection of 51 street lighting units along High St and Church La.—See 21 July issue.

28 July—Omagh. Electrical installation in new Crown Bldg, Mountjoy Rd, for M. of Finance.—See 30 June issue.

29 July—Aberdeen Harbour Commissioners. Supply of, item 11, electrical fittings for year.—See 14 July issue.

29 July—Blackpool C.B. Electrical work at Police buildings, South King St. Director of Lighting and Electrical Services, Rigby Rd East.

29 July—West Ham C.B. Supply and installation of two four-person passenger lifts. Borough Engineer, Town Hall, E.15.

30 July—Harlow U.D.C. Erection of 89 Group "B" columns, four Group "A" columns, fixing of 24 wall brackets, fitting/wiring of lanterns/control gear together with ancillary works.—See 14 July issue.

1 Aug.—Kinross C.C. Electrical work in two semi-detached houses at Cleish. County Clerk, D. A. R. Cuthbert, County Bldgs, Kinross. Applications by above date.

2 Aug.—Lancs C.C. Rewiring of kitchen and dining room, Middleton Elm St County School. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date, quoting reference A/G.

2 Aug.—Manchester C.C. Supply of lamps for year from 1 Nov., 1960. City Surveyor, Town Hall, Manchester 2.

3 Aug.—Kingston upon Hull C.C. Electrical installation in factory and office building consisting of 416 lighting points, 153 switches, 81 switch/sockets, sanitary incinerators, shaver supply unit and 41 three-phase outlets.—See 21 July issue.

3 Aug.—N. Ireland. (c) Electrical installation in 456 Antrim Rd, Belfast, for Milk Marketing Board. Applications to General Manager, Castlehill Rd, Belfast 4, by above date.

3 Aug.—West Riding C.C. Rewiring of residential block at Horsforth Springfield Special School. Divisional Architect, Salisbury Bldgs, Albert St, Harrogate.

5 Aug.—Romford B.C. Lighting included in private street works programme for (1) Parkland Ave and Lake Rise; and (2) Parkway.—See 21 July issue.

6 Aug.—Bacup B.C. Supply and erection of street lighting along 1·5 mile Todmorden Rd and 0·9 mile Booth Rd.—See 21 July issue.

8 Aug.—Newbury B.C. Supply and erection of 30 140 W sodium lanterns to replace existing tungsten lanterns, moving of four steel columns and the erection of one new column.—Advertised 21 July issue.

8 Aug.—Wadebridge R.D.C. Supply and installation of 33 400 W colour-corrected mercury lamps for 25 ft mounting for A39 lighting and six similar lamps at The Platt.—See 21 July issue.

9 Aug.—Co. Londonderry. Electrical installation in new voluntary primary school at Swatragh.—See 21 July issue.

10 Aug.—Horncastle R.D.C. Provision and maintenance of two 104 g.p.m. vertical spindle pumps complete with motors, starters and accessories. Details from consulting engineers: J. H. Haiste and Partners, Belmont Hse, 20 Wood La, Headingley, Leeds. Deposit £3 3s, made payable to R.D.C.

10 Aug.—Surbiton B.C. Installation of 193 sodium and 270 colour-corrected mercury Group "A" lighting points—See 14 July issue.

10 Aug.—Wortley R.D.C. Installation, complete, of colour-corrected mercury lighting: scheme 54, Ecclesfield bus route, 67 125 W on 20 ft columns; scheme 55, Stannington bus route, 60 80 W on 15 ft columns; scheme 57, Chapeltown to High Green, 74 125 W on 20 ft columns; scheme 58 (part), Chapeltown 29 250 W on 25 ft columns.—See 14 July issue.

12 Aug.—Larne B.C. Electrical installations in: (a) shops and flats at Antiville; (b) 7/4 scheme of 50 dwellings; (c) 75 scheme for 52 dwellings.—See 7 July issue.

12 Aug.—Redcar B.C. Erection of Stanton columns and E.L.E. Co./G.E.C./Siemens-Edison Swan lanterns for 1960-61 programme. Borough Engineer, Ridley Hse, Coatham Rd.

12 Aug.—Spenborough B.C. Electrical work in proposed Market Arcade, Albion St, Cleckheaton. Borough Engineer and Surveyor, Town Hall, Cleckheaton. Deposit £2 2s.

12 Aug.—Ulster Transport Authority. Supply of (Contract 65) batteries and battery plates; (Contract 77) accessories, adaptors, plugs and switches; (Contract 78) Empire cloth, p.v.c. and cotton sleeving for year from 1 Oct., 1960.—See 21 July issue.

15 Aug.—Birmingham C.C. Inspection and maintenance by passenger lift manufacturers of lifts on various flatted estates for 13 months.—See 21 July issue.

15 Aug.—East Ham C.B. Supply and erection of (1) lighting columns, (2) street lighting equipment comprising 35 15 ft concrete and one 25 ft steel column together with lanterns, lamps and ancillary gear. Borough Engineer, Town Hall, E.6. Deposit £2 2s.

15 Aug.—Wick T.C. Electrical work in erection of 92 houses in Willowbank sixteenth development.—See 21 July issue.

16 Aug.—Chesterton R.D.C. (a) Supply and erection of 260 15 ft concrete columns with 60 W sodium lamps/lanterns; (b) supply and erection of 95 15 ft columns with 100 W tungsten lamps/lanterns; (c) conversion of 320 c.i. gas columns for use with 100 W tungsten units; (d) dismantling of existing gas installation. Engineer and Surveyor, County Hall, Hobson St, Cambridge. Deposit £2 2s.

16 Aug.—Islington B.C. Design, provision and installation of floodlighting at Market Rd playground.—Advertised 14 July issue.

16 Aug.—Lichfield C.C. Supply and installation of 26 Group "B" concrete columns with sodium lanterns/ancillary equipment and dismantling and re-erection of six c.i. columns along Weston Rd, Curborough Rd, etc. City Engineer and Surveyor, D. Oglesby, Meredith Hse, 62 Wade St.—Advertised in this issue.

18 Aug.—Cookstown. Electrical installation in hostel and extension at Loughry Agricultural for M. of Finance.—See 21 July issue.

19 Aug.—Pocklington R.D.C. Contract 2. Supply and erection at Melbourne of four 50 g.p.m. sewage ejectors complete with motors, starters and accessories. Details from consulting engineers: J. H. Haiste and Partners, Belmont Hse, 20 Wood La, Headingley, Leeds. Deposit £3 3s, made payable to R.D.C.

20 Aug.—Bournemouth C.B. Provision and erection of two 260 kW dual fuel alternator sets and associated switchgear for contract 3, Holdenhurst Sewage Disposal Works. Borough Engineer, Town Hall.

20 Aug.—North Shields. Rewiring of two wards at Preston Hospital.—See 21 July issue.

22 Aug.—Castlederg R.D.C. Supply and erection of 79 fluorescent lanterns, etc. Council Clerk, J. B. Williamson, Council Offices, Castlederg, Co. Tyrone. Deposit £5 5s.

22 Aug.—Chelmsford. Subcontract 16. Provision and installation of cables, external lighting, heating and lighting of buildings, power distribution and control equipment for extension 2 at Brookend Sewage Disposal Works.—Advertised 21 July issue.

22 Aug.—Ellesmere Port B.C. Provision and erection of 58 Group "A" columns, taking down 34 Group "B" columns and re-erection. Borough Engineer and Surveyor, Queen St.

22 Aug.—Enfield B.C. Section A: Supply of 316 140 W and 181 60 W integral jacketed sodium lamps, lanterns and gear. Section B: Supply of 316 25 ft and 181 15 ft concrete columns. Section C: Erection of columns/brackets/lanterns and removal of existing columns. Borough Engineer and Surveyor, H. D. Peake, 7 Little Park Gdns. Deposit £2.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Ticino" lighting switches—suppliers of? L.E.B.—Sam's Electrical London Ltd., 9-11 Tabernacle St, E.C.2.

Centro-Vac Ltd.—address for? M.E.M. 146 Marylebone Rd, N.W.1.

Interlock Metal Tubings Ltd.—address for? S.E.—Kempston Flex Works, Bedford.

"Calor" extractor fans—suppliers of? T.E.—S. I. Engel and Co., 23 Kensington Park Rd, W.11.

"Constat" thermostats—makers of? E.E.B.—The Thermostatic Controls Co., Avenue Rd, Hampton, Middx.

"Cromwell" heated water tanks—makers of? R.L.—Rolyat Tank Co. Ltd., Cromwell Rd, York.

"Ventmaster" window fans—makers of? B.B.—Mastervent Eng. Co., 11 Mauldeth Rd, Manchester 20.

Triangle Products Ltd.—address for? E.E.B.—Manchester Rd, Hyde, near Manchester.

"A.E.T." toasters—suppliers of? Y.E.B.—G.E.C. of Ireland Ltd., Adelaide Rd, Dublin.

24 Aug.—Bridge-Bleau R.D.C. Supply of duplicate 75 g.p.m. against a 105 ft head vertical spindle direct coupled centrifugal sewage pumps for Tyler Hill scheme.—See 14 July issue.

31 Aug.—Renfrew T.C. Erection of alternative (a) 3 x 80 W fluorescent and (b) 400 W mercury schemes for A8 Inchinnan Rd street lighting improvements.—See 21 July issue.

31 Aug.—Wilton B.C. Installation of street lighting at Bulbridge Private Development Estate. Borough Surveyor, Municipal Offices.

1 Sept.—Dundee T.C. Supply and erection of multi-stage centrifugal pumps, accessories and switchgear for Menzieshill Pump Hse.—See 21 July issue.

1 Sept.—Kirkby-in-Ashfield U.D.C. Supply and installation of two 20 c.f.m. and one 35 c.f.m. sewage pumps and one 35 c.f.m. sludge pump complete with starters, switchgear, cables, etc. Details from W. H. Radford and Son, 57 Goldsmith St, Nottingham. Deposit £3 3s, payable to U.D.C.

1 Sept.—Warrington R.D.C. Installation of 48 Class "B" street lighting units on A574, Warrington Rd, Risley.—See 21 July issue.

3 Sept.—Cambridge C.C. Supply of Item (d) lamps.—See 14 July issue.

10 Sept.—Waterford C.C. Supply of two 20 g.p.m. centrifugal pumps and motors for Kill and Bonmahon Water Supply Scheme. Details from consulting engineers: H. N. Walsh and Partners, 47 Sunday's Well, Cork. Deposit £2 2s.

No date stated—Berks C.C. Supply and erection of 28 35 ft steel columns, lanterns and other work for Oxford Southern and Western By-pass scheme, Botley and Woodstock Rd roundabouts.—Advertised 30 June issue.

No date stated—Herefordshire C.C. Installation of 210 lighting units for traffic signs on Ross Spur Motorway. County Surveyor, Portfield Hse, Hereford.

No date stated—Lanark. Electrical work in (a) Wards 7 and 8 and (c) Nurses' Home, phase IV at Stonehouse Hospital.—See 21 July issue.

No date stated—Southampton C.B. Electrical and mechanical work in (a) electrical machines laboratory and (b) steam engines laboratory at College of Technology.—Advertised 14 July issue.

No date stated—S. Warwickshire Hospital Group. Applications invited for inclusion in approved list of electrical contractors.—See 14 July issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

4 Aug.—Pakistan. ¾ to 200 h.p. 400/440 V squirrel cage induction motors. M. M. Ispahani Ltd., Ispahani Bldg, McLeod Rd, Karachi. B.o.T. (ESB/19107/60/ICA).*

8 Aug.—America. (1) One 115 kV horn gap switch; (2) three 115 kV disconnecting fuses; (3) three 2·4 kV disconnecting fuses. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center, Denver, Colorado. B.o.T. (ESB/18817/60).*

6 Aug.—Iraq. 130 kilometres o/h line and 2,250 metres 11 kV cables for Central Euphrates Zone. Directorate of Legal Affairs, Ministry of Industry, Baghdad. B.o.T. (ESB/18875/60)*

10 Aug.—Pakistan. One 50 kV portable test set for cables. Chief Engineer, Electricity, W.A.P.D.A., Lahore. B.o.T. (ESB/18827/60).*

10 Aug.—S. Africa. 15 items insulating materials including glass tape, paper-mica-paper sheet, tape and varnished glass sleeving. Secretary, Union Tender Board, 291 Bosman St, Pretoria. B.o.T. (ESB/18465/60).*

12 Aug.—South Africa. 581 3 kV d.c. automatic reclosing and lockout relays for S.A. Railways. Chairman of the Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (ESB/18819/60).*

13 Aug.—Iraq. 250 kW diesel alternating set. Secretary of Contracts and Purchases, Ministry of Municipalities, Baghdad. B.o.T. (ESB/18480/60).*

16 Aug.—Argentina. 400,000 dry batteries. Departmento de Abastecimiento, Empresa Nacional de Telecommunicaciones, Av. La Plata 1540, Buenos Aires. B.o.T. (ESB/18878/60).*

16 Aug.—New Zealand. 1,640 yd 15-core 7/·029 pilot cable. Town Clerk, Town Hall, Wellington. B.o.T. (ESB/18687/60).*

18 Aug.—Australia. 3·3, 33, 66 and 132 kV surge diverters. Design Dept., Electricity Trust of S.A., Hindmarsh Bldg, Grenfell St, Adelaide. B.o.T. (ESB/18825/60).*

20 Aug.—Nigeria. One 250 kW diesel alternator set for Maiduguri. Details from Resident Engineer, Electricity Corpn. of Nigeria, c/o Adelphi, John Adam St, W.C.2.

26 Aug.—S. Africa. 50 items of silicone rubber insulated cables. Secretary, Union Tender Board, 291 Bosman St, Pretoria. B.o.T. (ESB/18466/60).*

31 Aug.—India. Eight 500 kVA 33/11 kV transformers, group and disconnecting switches, lightning arresters, 22 11 kV o.c.b's, potential transformers and fuses. Chief Engineer (Electricity), Mysore State Electricity Board, P.B. 15, Bangalore. B.o.T. (ESB/18056/60).*

31 Aug.—S. Africa. 59 items—cables. Secretary, Union Tender Board, 291 Bosman St, Pretoria. B.o.T. (ESB/18467/60).*

2 Sept.—New Zealand. One 3 ton and one 1½ ton o/h travelling cranes. Chief Engineer, Wellington Harbour Board, P.O. Box 893, Wellington. B.o.T. (ESB/18470/60).*

5 Sept.—India. Four items 1·1 kV grade p.i.l.c.d.s.t.a. cable and one metal-clad l.t. switchboard. Chief Engineer, Madra Port Trust, Madras. B.o.T. (ESB/1836 and 7/60).*

CONTRACTS PLACED

C.E.G.B. Contracts placed during the past month, amounting in the aggregate to approximately £4,930,000, include: Thorpe Marsh power station: 415 V switchgear, switch-fusegear, motor control gear, and accessories, English Electric Co. Ltd.; High Marnham power station: scrapers for coal handling, John Blackwood Hodge and Co. Ltd.; Skelton Grange "B" power station: three site shunting locomotives, The Yorkshire Engine Co. Ltd., canal barge coal unloading plant, Clyde Crane and Engineering Co. Ltd.; Blyth "B" power station: booster, starting and standby boiler feed pumps for Nos. 7 and 8, 350 MW turbo-generators, Sulzer Bros. (London) Ltd.; Rugeley power station: 3·3 kV air-break, 150 MVA switchgear, A. Reyrolle and Co. Ltd., 415 V contactor switchgear, Brookhirst Igranic Ltd.; Uskmouth "B" power station: one 144 MVA 13·8/145·4 kV transformer No. 3, The General Electric Co. Ltd.; Aberthaw power station: 6·6 kV, 250 MVA switchgear and accessories, A.E.I. Ltd.; Richborough power station: instruments and control equipment, Electroflo Meters Co. Ltd.; Brunswick Wharf power station: uprating 132 kV switchgear, A.E.I. Ltd.; Kirkby 132 kV substation: 132 kV outdoor switchgear, A.E.I. Ltd.; High Marnham substation: one 400 MVA, 380/275 kV, auto-transformer, The English Electric Co. Ltd.; Monk Fryston substation: one 400 MVA 380/275 kV, autotransformer, Ferranti Ltd.; Corby substation: two 180 MVA, 275/132 kV transformers, The English Electric Co. Ltd.; Bustleholm substation: two 180 MVA, 275/132 kV transformers, The General Electric Co. Ltd.; Brinsworth substation: 275 kV, 7,500 MVA switchgear, A.E.I. Ltd.; Nechells substation: 132 kV, 3,500 MVA switchgear, The General Electric Co. Ltd.; Brinsworth substation: 275 kV overhead lines, British Insulated Callender's Cables Ltd.; Rugeley-Whitfield: 132 kV overhead line, A.E.I. Ltd.; Ironbridge-Oswestry: 132 kV overhead line, Balfour Beatty and Co. Ltd.; Hart Moor substation: civil works, Tarslag Ltd.; Whitson (Newport Steelworks) substation: site and foundation works, A. Jackaman and Son Ltd.; Willesden Grid-Taylors La: 132 kV and 33 kV cabling, Pirelli-General Cable Works Ltd.; Basildon-Pitsea: 25 kV cabling, British Insulated Callenders' Cables Ltd.

C.E.G.B. (E. London and S.E. Region). Contracts placed during May/June over £5,000 value include: Acton La, civil works, Major Constructors Ltd., £8,057; Taylors La, 132 kV switchgear, A. Reyrolle Ltd., £9,268; Willesden T/S, 132 kV switchgear modifications, A. Reyrolle Ltd., £5,971; Wimbledon, 33 kV switchgear modifications, A. Reyrolle Ltd., £26,896; Folkestone/Sittingbourne/Thanet/Canterbury, metering, Ferranti Ltd., £5,439; Sittingbourne, civil works, Corben and Sons, £9,300; Brighton "B" P/Station, ash telpher equipment, Babcock and Wilcox, £9,038; Brighton "B" P/Station, turbine spares, Richardsons, Westgarth, £8,936; Brunswick Wharf P/Station, uprating switchgear, A.E.I. Ltd., £163,555; Willesden Grid/Taylors La, 132/33 kV cabling, Pirelli-General, £58,654; Croydon "A" and "B", 33/6·6 kV cabling, Enfield Standard, £5,839; Leigh T/S, 132 kV switchgear, English Electric Co., £25,247; Hartley T/Station, 132 kV cabling, B.I.C.C., £5,352; Basildon/Pitsea, 25 kV cabling, B.I.C.C., £133,691; Letchworth, civil works, J. L. Eve, £15,744; Peterborough, 132/33 kV cabling, B.I.C.C., £25,368; Rayleigh/Barking, 132 kV overhead line, Watshams, £17,373.

Dorchester B.C. Rewiring 76 houses, Roger and Dawes Ltd., £1,357. Recommended.

Sheffield. Electrical work for central boilerhouse at City General Hospital. Volt N. A. Cockcroft, £1,296. Recommended.

Stockport B.C. Electrical installations in 59 dwellings in York St redevelopment, Piggott and Whitefield Ltd., £4,618. Recommended.

Swinton and Pendlebury B.C. Electrical work in Moorfield Homes for the Aged, N. A. Cockcroft, £1,296. Recommended.

Tonbridge R.D.C. Electrical installations in 44 flats, G. P. Cree Ltd., £1,144.

TRADE NOTES

Change of Address. The head office of Malcolm and Allan (London) Ltd. has been moved to 229 High St, Acton, W.3. Telephone: Acorn 7811.

The Sales Dept. of Joseph Sankey and Sons Ltd. is now at 168 Regent St, W.1. Telephone: Regent 3261.

The departments dealing U.K. instrument sales, instrument service and despatch, and the Exports Division of the Solartron Electronic Group Ltd. have moved to Cox La, Chessington, Surrey. Telephone: Lower Hook 2150.

The Birmingham sales office of High Duty Alloys Ltd. has moved to 369 City Rd, Edgbaston, Birmingham 16. Telephone: Bearwood 2344.

Change of Name. As from 2 Aug., C. C. Wakefield and Co. Ltd. are to be known as Castrol Ltd.

Agency. Findlay, Durham and Brodie Ltd., 6 Bloomsbury Sq, W.C.1, have been appointed London agents for South African Porcelain Insulator Manufacturers Association Pty. to handle inquiries from abroad for various types of insulators and ceramics.

Holidays. The works of Transformers (Watford) Ltd. will be closed from 25 July to 9 Aug.

The Leeds works of Geo. Bray and Co. will be closed from 29 July to 15 Aug., but the offices will remain open.

BUSINESS PROSPECTS

Barnsley T.C. Tender: Waterworks mechanical plant store, Scout Dyke, Penistone. Waterworks Engineer and Manager.

Birmingham. Industrial developments planned: Barr St for Moorgate (Birmingham) Ltd., 85 Ryland Rd, Birmingham 15, £24,000; Lord St for H. Davis, Snow Hill, Birmingham 4, £18,000: Macdonald St for George Owen and Son, Florence St, £10,000; Bissell St for Stechford Fireplace and Plumbing Co., 113 Stechford La, £13,000; Summer La for Unit Welding and Manufacturing Co., £7,000; Proctor St for M. Kaplan and Co., 177 Sherlock St, £15,000; Bissell St for Auster Ltd., Barford St, £10,000; and Lawrence Bros., Pershore St for warehouse, £17,000.—T.C.: 14 dwellings, Woodcock La, and tenants' meeting room, Holloway. Architect.

Bournemouth. M. Chapper plans five industrial buildings, next 490-2 Wallisdown Rd. Martin and Martin, 5 Hyde Gdns, Eastbourne, surveyors.

Bradford T.C. Tender: 64 Bradford Rd, Clayton, dwellings. Engineer and Surveyor.

Brentford. Clive Pascal and P. Watson, 24 Half Moon St, W.1, architects for £150,000 offices, Great West Rd.

Bromsgrove U.D.C. Tender: 15 houses, five bungalows, Barrington Rd estate. Engineer.

Brighton. Sir Basil Spence and Ptnrs, 1 Canonbury Pl, N.1, architects for £1½ million University College.

Bristol. Crompton Parkinson, Aldwych, W.C.2, plan Brislington trading estate development.—Beasley French and Co., Vale La, plan industrial development Vale La.—Colodense Ltd., West St, Bristol 3, plan five-storey office block Bedminster.—Griggs and Sons, 56 Victory St, S.W.1, contractors for Redland College teaching block, £230,620. Kenneth Wakeford, Jerram and Harris, 8 Upper Berkeley Pl, Bristol, architects for Broadweir and Southern Properties Ltd.'s 30,000 sq ft Broadmead store.

Cardiff. Hasker and Hall, Longdon Hse, Knowle, architects for The Rover Co.'s development of Pengam airport site; workshops, canteen, etc.

Carlisle. Graham, Roy and Nicholson, 6 Paternoster Row, architect for West Cumberland Farmers' Trading Society poultry packing station, Harraby Green.

Consett. B.R. (NE Region), York, plan goods station.

Crawley. Anders and Dalton, 100 High Rd, Ilford, Essex, architects for Batteries Ltd. factory offices, Flemming Way.

Cumberland C.C. A £¼ million Egremont comprehensive school planned. Architect.

Darlington. E. Gordon Crofts, 49 Grange Rd, architect for C. H. Hugh Ltd.'s McMullen Rd factory. E.C. plans £11,000 additions to Barnard School and £58,000 additions to Eastbourne Secondary School.

East Sussex C.C. Tender: Four-storey classroom block, cloakroom, gym, etc., Newhaven County Secondary School. Architect.

Edinburgh T.C. Tender: Springwell Hse mock control centre. Architect.

Edmonton. Middx C.C. plan Silver St site clinic.

Gainsborough U.D.C. Gibbons Sq, blocks of flats planned. Surveyor.

Gateshead. Clarke, Chapman and Co. plan Neilson Rd offices to own plans.

Godalming. Langham Cement Products, Cattleshall La, contractors for £20,000 Langham Trading Estate factory for Langham Estate Developments Ltd.

Harpenden. D. Chaston, Hoddesdon, Herts, contractors for shops and flats, Church Green, for Felnex Northern Properties Ltd.

Heanor. Aristoc Ltd. plan dye house extensions, North St, Langley Mill.—I. and R. Morley Ltd. plan Fair View canteen.

Hove. Morgan and Carn, 12 Grand Ave, architects for Kingsway Hotel site block of flats, for Kingsway Court (Hove) Ltd.

Hull. Eskimo Foods, Strickland St, plan Madeley St and Walcott St area site developments.—Arlington Barfitting and Chemical Co., 59 Selby St, plan Wassand St land development.—J. C. Moxley, Central St, have leased land industrial site 5.—Transport Development Group plan West Carr La, Stoneferry, cold store.—W. D. Mark and Sons, 18 Sewer La, plan industrial site 4 (Clough La) cold store.—Gelder and Kitchen, Alfred Gelder St, architects for Manufacturers' Equipment Co.'s Leeds Rd administrative block.—Physics building, Cottingham Rd, planned for University.

Ilford B.C. Tender: Two blocks 12 flats and four blocks 12 flats. The Glade. Engineer.

Keighley B.C. Tender: 93 houses, Hainworth Rd estate. Architect.

Kesteven. Farm Institute, Fulbeck, has £100,000 three-year development plan.

Leeds. Ansell and Bailey, 12 Gray's Inn Sq, W.C.1, architects for £200,000 multi-storey office block, Eastgate, for National Deposit Friendly Soc.

Leicester. H. Owen Luder, 79 Regency St, S.W.1, architect for £100,000 Royal Opera House site shops arcade.

Leicestershire C.C. Stage 1, Wigston Rural Science Centre, £1,000 planned.—Stage 2, Hinckley Grammar School, £226,740 planned.—Stage 2, Groby School, £40,500 planned. Market Harborough C.E. School planned. County Architect.

Leigh B.C. Tender: 32 Siddow Common flats. Housing Director, Housing Dept., Windermere Rd.

Letchworth. Tender: Factory extensions, International Computors and Tabulators Ltd., Blackhorse La. Architect: Hugh D. Roberts, 30 Brock St, The Circus, Bath.

Lindsey C.C. Science block planned for King Edward VI Boys' Grammar School, Louth, County Architect.—£10,000 Youth Centre, Skegness planned. County Architect.

Liverpool. Andrew Bros., 34 Regent St, plan 90,000 sq ft factory, Wareing Rd, Aintree.

Llwchwr U.D.C. Tender: 17 blocks six dwellings, Loughor, Gowerton and Gorseinon. Architect.

Londendale U.D.C. Tender: 12 two-storey flats, Taylor St. Surveyor.

London. Hendon B.C. to build flatted factory, North Circular Rd.—Tripe and Wakeman, 16 Fitzhardinge St, W.1, architects for Schweppes Ltd. plant, offices and vehicle maintenance shop, The Hyde, N.W.9.—J. Beard, Bennett and Wilkings, 101 Baker St, W.1, architects for Nuffield Nursing Home Trust nursing home, Bryanston Sq site.—L.C.C. plan London School of Printing and Graphic Arts, Elephant and Castle area, £1 million project with 13 floors. Architects' Divn.—Gordon Jackson and Ptnrs, 1 Gray's Inn Pl, W.C.1, architects for All Saints C.E. School, N.W.2.—St. Joseph's College, Lawrence St, residential block planned.—Cheapside Land Development Co., 9 Devereux Ct, Fleet St, W.C.2, plan luxury offices, Winchester Hse site, Old Broad St.—Boissevain and Osmond, 2 Field Ct, Gray's Inn, W.C.1, architects for £1¼ million Elephant and Castle, S.E., shopping centre.—F. E. White, 51b Tollington Park, N.4, surveyor for Borough Rd office building, S.E.1.—Capital and Counties Property Co., 4 Lloyds Ave, E.C.2, plan £200,000 shops/flats scheme, Lowndes St and West Halkin St.—E. A. Stone, Toms and Ptnrs, 28 South Audley St, S.W.1, architects for Hyde Park Sq site development.—£450,000 shops/flats block on site of Winter Garden Theatre, Drury La, planned and new theatre on adjoining property, planned by Pearson, Forsyth and Co., 10 Stratton St, W.1.—S. Smith and Sons, Edgware Rd, Cricklewood, N.W.2, plan multi-storey office block.

Loughborough T.C. 137 houses planned on four sites. Surveyor.

Manchester. Regional Hospital Board plans Rochdale Infirmary out-patients' dept. —Lancashire C.C. approves £300,000 College of Music new town centre.

Mansfield. Harwood Cash and Co. plan third storey to Rosemary St factory.—J. Maude and Co. plan Nottingham Rd/Forest Rd foundry additions.

Morpeth T.C. 89 Spelvit La houses planned. Engineer.

New Sarum T.C. Tender: Six houses, 58 flats and garages, Essex Sq and West Harnham. Engineer.

Newcastle. A £¾ million College of Further Education planned by C.C. approved. City Architect.—T.C. plans 48 maisonnettes, Shieldfield; 108 maisonnettes, 45 houses, Walker; and 125 houses, etc., Newbiggin Hall estate. Architect.—Barrett, Sons and Ptnrs, High Bridge, quantity surveyors for Hospital Board's planned General Hospital casualty dept.—Mouchel and Ptnrs, 24 Claremont Pl, consulting engineers for Board's General Hospital boiler house and laundry.—D. Brown, 10 Lambton Rd, Jesmond, architect for planned additions to St. Cuthbert's Girls' School, Gretna Rd.—S. W. Milburn and Ptnr, 9 Esplanade, Sunderland, architects for conversion of Grainger Cinema to G. A. Dunn and Co. shop.

Norfolk. C.C. plans £85,000 teaching accommodation, Wymondham College and Wells Secondary School.

Northallerton. R. W. Gregory and Ptnrs, Pilgrim Hse, Pilgrim St, Newcastle, consulting engineers for nurses' accommodation, Friarage Hospital.

Northants C.C. £36,000 block of flats, Corby planned. Architect, Northampton.—£45,000 home, Gainsborough Rd, Corby planned.

N. Riding. Wheatley, Byron and Ptnrs, 2 Down Pl, W.6, structural engineers for Loftus County Modern School.—D. C. Hall, Duke St, S.W.1, architect for £42,000 Ormesby Infant School.

Oxford. Kingerlee and Sons, Lamarch Rd, Botley, contractors for training centre, The Poplars, for Pressed Steel Co.—W. Lucy and Co., Eagle Ironworks, plan extensions, Walton Meadow, Walton Well Rd.

Ploughley R.D.C. Tender: 26 Park Hill houses. Engineer and Surveyor.

Portsmouth. C. E. Petch, 25 Landport Terr, architect for improvements to St. Mary's Hse, Milton, at £49,000. Plans include central heating, lifts and renewal of electric wiring.

Reading. Mager and Greenaway, 15 Castle St, quantity surveyor for Norcot clinic.

Sedgefield. Newcastle Hospital Board, Benfield Rd, Newcastle, plan modernisation of nurses' home, Winterton Hospital.

Sheffield. Regional Hospital Board plan resident block Doncaster Infirmary.

Southwick U.D.C. Tender: 32 shops, 32 flats and maisonnettes and garages. Clerk.

Spalding U.D.C. 42 flats £55,000 Windsor Estate planned. Surveyor.

Stalybridge. Clinic and offices planned by Cheshire C.C. at Stamford St and Market St.

Stockton-on-Tees. E. W. Chapman, 125 Acklam Rd, Thornaby-on-Tees, architect for Stockton and Thornaby Hospital operating theatre.

Stratford-on-Avon. Tender: New library and administrative block proposed by Shakespeare's Birthplace Trustees. Architects: Wood and Kendrick and Williams, 57 Colmore Row, Birmingham 3.

St. Helens R.C. Tender: 24 bungalows, Houghton Rd. Architectural office.

Sunderland. J. H. Ainslie and Co., East Cross St, plan industrial development on East Cross St land.—Ericsson Telephones, North Hylton Rd, Southwick, Sunderland, plan factory extensions. Architects: Newrick and Blackbell, 58 John St.

Thetford. Goddards of Thetford (1954), Station Rd. contractors for £23,894 factory for G. Williams Engineering Co., Disraeli Rd, N.W.10.

Tottenham B.C. Tenders: 76 dwellings on Warwick Gdns, Fairfax and Effingham Rd sites and 18 Park La flats. Engineer.

Business Prospects continued

Tynemouth. Wood and Pigg, 17a Northumberland Sq, N. Shields, architects for sheet metal works extensions, Clive St, N. Shields, for G. S. Robinson and Co.

Watford. Ever Ready Co. (Gt. Britain) plan three-storey extension to Lower High St factory building.—Abrasive Blades Ltd. plan factory extensions, Greenhill Cres, Holywell Estate.—M.E. Developments Ltd. plan shop-canteen, Bushey Mill La.—Transformers (Watford) plan shop at Sandown Rd.—A.A. polishers and Platers, Loates La, plan factory/offices, Holywell Estate.

West Hartlepool. E.C. plans new premises for Claremont Special School.

Wick. £55,000 factory planned by Scottish Industrial Estates, 3 Woodside Pl, Glasgow, C.3.

Wilts. Hardy and Son, Brown St, Salisbury, plan Wilton industrial development.

Wolverhampton. T.G. Construction Co., Ettingshall, contractors for £237,000 factory at Fordhouses for Turner Manufacturing Co., Ettingshall.

Worthing. M. Rainsford Fletcher and Ptnrs, 13 Ambrose Pl, architects for warehouse, Ivy Arch Rd, for Roberts and Son.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Automatic Switching (Distributors) Ltd., 143-149 Gt. Portland St, W.1. Manufacturers of and dealers in electrical and electronic apparatus and equipment, etc. Nom. cap.: £100. Dirs.: Geoffrey L. Newmark, Derek D. Rothschild, Leslie J. Robson and Keith C. Goldie-Morrison.

Brother International Co. (U.K.) Ltd. Manufacturers of and dealers in sewing machines, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: Bruce H. Walker, 2 Raymond Bldgs, W.C.1, and Charles L. Clarke, 38 Normanton Rd, South Croydon, Surrey.

Cantelec Ltd., 190 Moulsham St, Chelmsford, Essex. Manufacturers of and dealers in electrical appliances, etc, etc. Nom. cap.: £100. Permt. dirs.: Wallace A. Cant and Paula Cant.

Coupe Electrics Ltd., 269 St. Anne's Well Rd, Nottingham. Nom. cap.: £2,000. Dirs.: Maurice H. Coupe, Wynne Coupe, James E. Ormandy, Florence M. Ormandy and Bernard F. H. Lowe.

Electrolyn Ltd. Electrical and electronic engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: B. R. Rickson, 154 Benhill Rd, Sutton, Surrey, and H. Lyne, 23 Kingsley St, S.W.11.

F.G.S. Ltd., 1 Rodney Gdns, West Wickham. Manufacturers, importers and exporters of electrical, domestic and household appliances, etc. Nom. cap.: £100. Dirs.: Fredk. G. L. Snell and Mrs Angela Snell.

Fingroom Electrical Ltd. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and Thos. A. Herbert, 156 Strand, W.C.2.

France's Electrical Engineers Ltd. Nom. cap.: £10,000. Dirs.: William G. France, Henry J. Langford, Mary J. France and Vincent J. M. Walker.

Freeman Electrical Co. (London) Ltd., 253 Whitechapel Rd, E.1. Nom. cap.: £5,000. Dirs.: Ronald Freeman and Mrs Hope Freeman.

Fullrange Electrics Ltd., 22 Queen St, E.C.4. Nom. cap.: £100. Dirs.: Francis A. Bunyan and Mrs Edith M. Bunyan.

Goodwash of East Anglia Ltd., 30 Suffolk Rd, Lowestoft. Manufacturers of and dealers in domestic and industrial washing machines, etc. Nom. cap.: £100. Dirs.: George R. Goody and Mrs Lesley J. Goody.

A. W. Gray (Electrical) Ltd., 31a Farm La, S.W.6. Electricians, electrical engineers, etc. Nom. cap.: £100. Dirs.: Albert W. Gray and Mrs Doris E. Gray.

Harrison Bros. Electricals Ltd., 69 Northgate, Halifax. Manufacturers of and dealers in television, radio and other electrical apparatus, etc. Nom. cap.: £2,000. Permt. dirs.: Geoffrey Harrison, David Jones, John W. Horner, Mrs Margaret L. Harrison, Mrs Doreen Jones and Mrs Joyce Horner.

H.J.C. Co. Ltd., 8 Woodshires Rd, Longford, Coventry. Electrical engineers and contractors, etc. Nom. cap.: £3,000. Dirs.: Horace J. Cheetham and Mrs Kathleen Cheetham.

Perry Industrial Developments Ltd. Electrical, mechanical, marine, constructional and general engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: B. Bray and Donald E. Strong, Lloyds Bank Chmbrs, Collingwood St, Newcastle upon Tyne 1.

Solent Electrical Supplies Ltd., 5 Quob La, West End, Southampton. Nom. cap.: £100. Dirs.: Peter E. Underwood and Mrs Joyce M. Underwood.

Thingwall Electrics Ltd., 1a Husley St, Liverpool 13. Nom. cap.: £100. Dirs.: Donald W. Roberts and Mrs Dorothy M. Roberts.

Gazette Announcements

COMPANIES ACTS

A. F. Osborne Ltd. Liquidator: A. T. Cheek, 346 Strand, W.C.2, released as from 1 July.

Sir Thomas Edelston and Partners Ltd. Liquidator: A. T. Cheek, 346 Strand, W.C.2, released as from 29 June.

Thermal Units Ltd. Creditors to send details to liquidator: J. H. Wilson, Bucklersbury Hse, Bucklersbury, E.C.4, by 2 Aug.

County Electronics (Markfield) Ltd. Mr R. A. Haigh, Court Chmbrs, Friar La, Leicester, appointed liquidator at extraordinary general meeting on 13 July.

Somerset Home Appliances Ltd. Mr P. W. Hort, 28 Baldwin St, Bristol 1, appointed liquidator at extraordinary general meeting on 7 July.

Range Electronics Co. Ltd. Meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 29 July, at 2.30 and 3 p.m., respectively.

Birmingham Electronic Products Ltd. Mr W. Le 'Resche Hand appointed liquidator at extraordinary general meeting on 18 July for the purpose of winding-up.

Partnership Dissolved

Coventry. Partnership between S. F. Cavanagh and S. C. Reynolds, electrical and neon engineers, carrying on business at 29 Gayer St, Bell Green, as C and R Electrical Services, dissolved as from 8 July. All debts to be paid by S. C. Reynolds who is carrying on the business.

BANKRUPTCY ACTS

Receiving Orders

High Court of Justice. J. R. McRae, electrical dealer, formerly carrying on business as J.R.M. Televisions at 13 Wigton Gdns, Stanmore, Middx. Receiving order dated 14 July.

Guildford. G. R. Jacobs and C. J. Trevethan, television, radio and electrical appliance retailers carrying on business as Dawn Electric Appliances, 192 Stroughton Rd, Guildford, and lately at 226 Connaught Rd, Brookwood. Receiving order dated 14 July.

Leeds. S. T. Robinson, electrical contractor, carrying on business at 70 Bayswater Rd, and formerly at 73 Pontefract La, Leeds. Receiving order dated 19 July.

Pontypridd and Ystradyfodwg. G. G. Burton and W. J. Newhams, wholesalers and retailers of domestic appliances, formerly carrying on business in partnership as Nuelectrics (Burton and Newhams) Co., at 222 Bute St, Cardiff. Receiving order dated 20 July.

Appointment of Trustee

Manchester. R. H. Dumbell, electrical goods retailer, carrying on business as L and D Electrics, at 330 Ashton Old Rd and previously in partnership at 233 City Rd, Hulme. Mr G. H. Eaves, 47 Moseley St, Manchester 2, appointed trustee as from 19 July.

Public Examinations

Bradford. E. Smith, electrical contractor, carrying on business at 28 Heaton Rd, Bradford 8. Public examination: 10.30 a.m., 16 Sept., at County Court, Manor Row, Bradford 1.

Middlesbrough. D. W. Delve, radio, television and electrical dealer, carrying on business at 182 High St, Eston, and at 107 Parliament Rd, Middlesbrough. Public examination: 11.15 a.m., 3 Oct., at Court Hse, Wilson St West, Middlesbrough.

Southend. G. D. Chaplin, electronics engineer, of Woodside, 18 Manor Rd, Woodford Bridge. Public examination: 11 a.m., 27 Sept., at 102 Alexandra Rd, Southend-on-Sea.

Application for Discharge

Barrow-in-Furness. C. Sykes, electrician, 10 High Kepplewray, Broughton-in-Furness. Application for discharge to be heard before the Magistrates' Court, Duke St, Barrow-in-Furness, on 11 Oct., at 10.30 a.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Citation. 797,506. Class 7. Sewing, knitting machines, etc. Brother International Corpn. (Europe) Ltd., Santry, Dublin.

Cordacall. 799,410. Class 9. Apparatus for recording and reproducing sound, etc. K. S. Paul (Printing Machinery) Ltd., Gt. Western Trdg. Estate, Park Royal Rd, N.W.10.

Creda Sealatch. 798,254. Class 11. Heating and cooking apparatus, etc. Simplex Electric Co. Ltd., Creda Wks, Grindley La, Blythe Bridge, Staffs.

Ever Ready. 778,623. Class 9. Plugs, sockets, etc. 778,624. Class 11. Kitchen utensils. Ever Ready Co. (Gt. Britain) Ltd., Hercules Pl, Holloway, N.7.

Gayspin and **Spin-Gay.** B788,836 and 7. Class 7. Washing and drying machines, etc. General Electric Co. Ltd., Magnet Hse, Kingsway, W.C.2.

Interchrome. 797,590. Class 9. Apparatus, etc. Chrome-Alloying Co. Ltd., London Bridge Hse, S.E.1.

Magnatect. 795,502. Class 1. Metallic particles in suspension for use in detecting flaws in ferro-magnetic materials. Dudley Drop Forging Co. Ltd., Holly Hall, Dudley, Worcs.

Sunshine Nu-Brite. B802,725 Class 11. Lamps, etc. Britannia Electric Lamp Works Ltd., 17-21 Sunbeam Rd, Chase Estate, N.W.10.

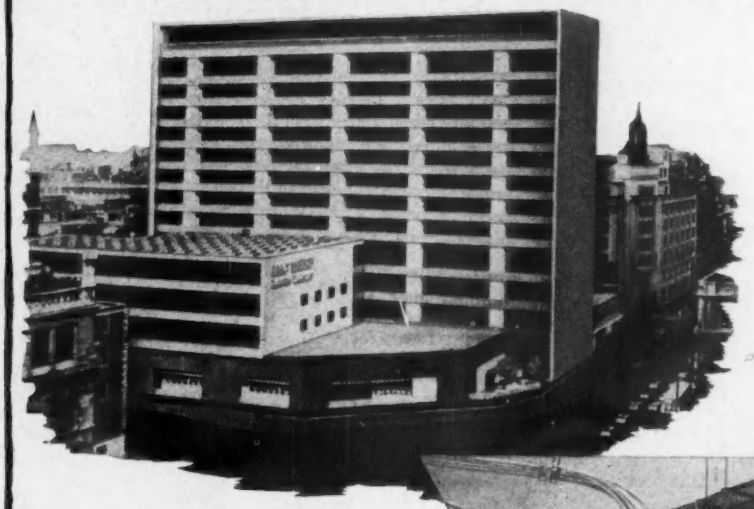
Sync Lock. 789,442. Class 9. Waveform generators with provision for locking, etc. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

Tricity Built-in. 800,241. Class 11. All goods. Tricity Cookers Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.

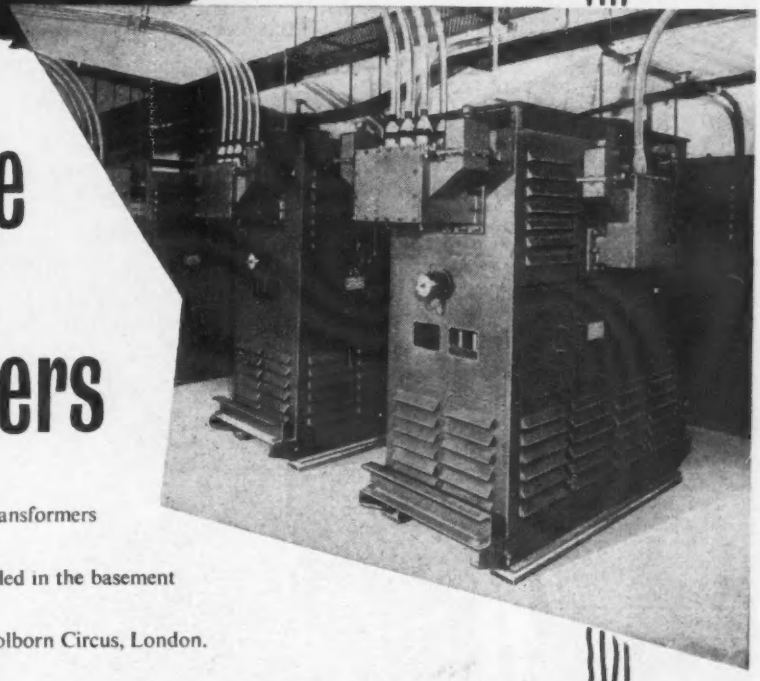
Volaxial. 799,339. Class 9. Apparatus, etc. 799,340. Class 11. All goods. Volex Electrical Products Ltd., 37 Brown St, Manchester 2.

Vyon. 800,479. Class 17. Plastics, etc. Pritchett and Gold and E.P.S. Co. Ltd., Dagenham Dock, Essex.

Wintermaster. B798,348. Class 10. Blankets. G. W. Stead, Jocelyn Sq, Glasgow C.1.



Artist's impression of the new Daily Mirror building at Holborn Circus.



Hackbridge

CLASS C INSULATED

Transformers

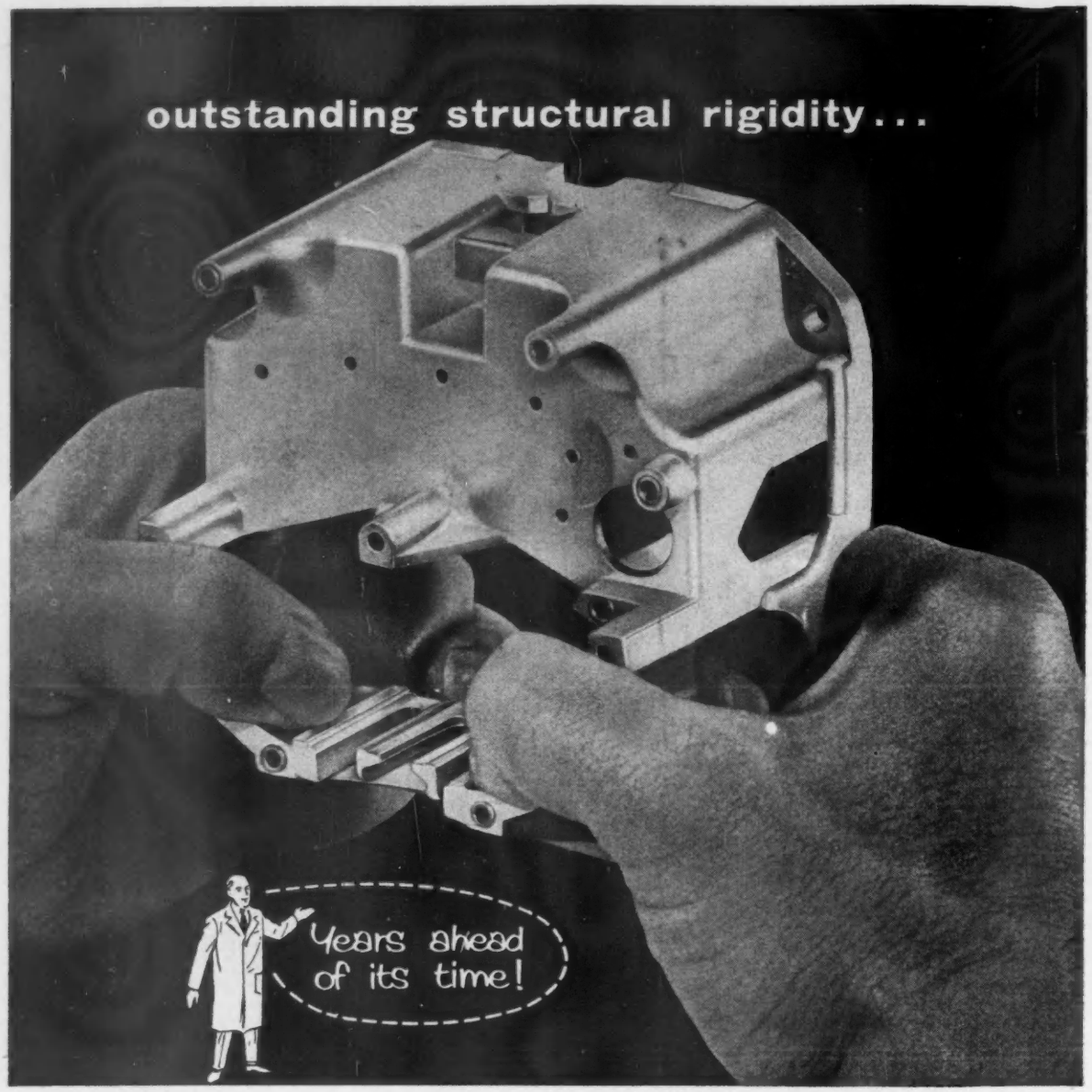
Ten 1,000 kVA Hackbridge dry type transformers with class C insulation have been installed in the basement of the new Daily Mirror Building at Holborn Circus, London.

A number of these units are illustrated on the right. The total capacity of Hackbridge class C transformers installed exceeds 50,000 kVA. Send for publication DB.31.

HACKBRIDGE & HEWITTIC ELECTRIC COMPANY LIMITED

Telephone Walton-on-Thames 28833 (8 lines) Telegrams & Cables "Electric, Walton-on-Thames"

OVERSEAS REPRESENTATIVES: ARGENTINA: H. R. Roberts & Cia., S.R.L. Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria; N.S.W.: Queensland: W. Australia: Elder, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BARBADOS** and surrounding islands: Electric Sales & Service Ltd., St. Michael. **BELGIUM & LUXEMBOURG:** Pierre Pollie, Brussels, 3. **BRAZIL:** Oscar G. Mors, Sao Paulo. **BRITISH GUIANA:** Dandor Commission Agency, Georgetown. **BURMA:** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Ess Ltd., Colombo. **CHILE:** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA:** G. A. Neumann Ltd., Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sahko-ja Konelitke O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE:** Glyndova Ltd. **GREECE:** Charilaos C. Coroneos, Athens. **INDIA:** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper, Gilfillan & Co. Ltd., Kuala Lumpur. **NETHERLANDS:** J. Kater, E.O., Ouderkerk a.d. Amstel. **NEW ZEALAND:** Richardson, McCabe & Co Ltd., Wellington, etc. **PAKISTAN:** The Karachi Radio Co., Karachi, 3. **SOUTH AFRICA:** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION:** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Port of Spain. **TURKEY:** Dr. H. Salim Oker, Ankara. **URUGUAY:** Ciuna Ltda., Montevideo. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA:** Oficina de Ingenieria Sociedad Anonima, Caracas.



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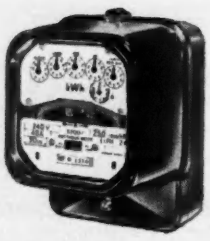
The SANGAMO Watthour Meter embodies the very finest in materials and design. The grid casting is an outstandingly fine example of modern production technique. Made from an aluminium silicon alloy of absolute stability, it is a one-piece pressure die-casting on which no subsequent machining operations are performed. No maintenance of any sort is required. By utilising the most advanced quantity production methods in the world's most modern meter factory, it has been possible to incorporate better materials, better workmanship and better design features with the utmost economy. Thus the benefits of increased demand are passed on to the user.



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SW/77

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

CITY AND COUNTY OF LICHFIELD

Group 'B' Street Lighting

WESTON ROAD, CURBOROUGH ROAD AND OTHER STREETS

TENDERS are invited for the supply, erection and installation of 26 concrete columns together with sodium lanterns and ancillary equipment. Also the dismantling and re-erection of six cast iron columns in new positions.

Application for contract documents should be made to the City Engineer & Surveyor, Mr D. Oglesby, M.I.MUN.E., Meredith Hse, 62 Wade St, Lichfield.

Applications must be accompanied by a deposit of £2 2s 0d which is returnable on receipt of a bona fide Tender not subsequently withdrawn.

Tenders in a plain sealed envelope endorsed "Street Lighting, Weston Road, Curborough Road and Other Streets" must be received by the undersigned not later than noon on Friday, 16 Aug., 1960.

The City Council does not bind itself to accept the lowest or any tender.

HENRY J. CALLENDER,
Town Clerk.

Guildhall,
Lichfield.
15 July, 1960. (R 512)

APPOINTMENTS VACANT

LONDON ELECTRICITY BOARD

ELECTRICAL ESTIMATING CLERK

APPLICATIONS are invited for the above position in the Board's Contracting Section at 16 Stratford Pl, London W.1.

Applicants should be capable of preparing tenders for electrical installations for generating stations and other large industrial premises, and should have had wide experience in taking-off quantities from architects' and consultants' drawings.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 3, i.e., £780/£880 per annum, plus the appropriate London Area Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref.: PER/V/3035/T. (R 499)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

GENERAL ASSISTANT ENGINEER (EFFICIENCY)

REQUIRED at Plymouth "B" Power Station.

Superannuation Scheme. Salary, N.J.B., Class H, Grade 13, Scale 4, £690/£785.

Duties will be of a general engineering nature in connection with efficiency and technical records. Applicants should preferably possess a Higher National Certificate. (Please quote ET/97/60.)

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 5 Aug., 1960. (R 507)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

DISTRICT COMMERCIAL ASSISTANT

REQUIRED for Western District based on Dunfermline, to undertake consumers' service, operation of Service Centres and supervision of sales and repair workshops; possession of E.D.A. Certificate an advantage.

N.J.C. conditions. Salary: Grade 3, £780/£880 p.a.; post superannuable, subject to satisfactory evidence of health.

Applications, on standard form obtainable from Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than 12 Aug., 1960. (R 516)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 193/ET/60.

APPLICATIONS invited for the superannuable N.J.B. appointments of PLANT CONTROL ENGINEERS AT USKMOUTH "B" POWER STATION, WEST NASH, NR. NEWPORT, MON.

Salary: Schedule A, Class K, Grade 10, Scale 9, £950/£1,055 per annum, plus 10% shift enhancement.

Experience of operation of modern high pressure and temperature reheat unit plant desirable. Candidates will be required to supervise the operation of units to achieve maximum thermal efficiency and safe operation. Higher National Certificate or equivalent qualification essential.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 12 Aug., 1960. (R 509)

WALES GAS BOARD

APPOINTMENT OF ENGINEERING ASSISTANT (ELECTRICAL)

APPLICATIONS are invited for the position of Engineering Assistant (Electrical) in the Mechanical Engineer's Department, Technical Headquarters, Cardiff.

Applicants should have received a good technical education to a minimum standard of Higher National Certificate in Electrical Engineering and be experienced in the preparation of specifications and wiring diagrams for the installation of all types of motors, generators, switchgear and electrical instruments. Experience in the installation of the above associated with gas-producing and gas-transmission machinery would be an advantage.

Experience in L.V., M.V. and H.V. supplies would be an advantage and the applicant must be familiar with all the latest Codes of Practice, I.E.E. Regulations and the Electricity Regulations of the Factories Act.

The salary offered is within A.P.T. Grade 12, of the National Salary Scales for Gas Staff (£1,006/£1,131 per annum). The position is pensionable.

The successful applicant will be required to pass a medical examination.

Applications giving the names of two referees must be received by the undersigned not later than Wed., 10 Aug., 1960.

C. B. MAWER,
Secretary.

Wales Gas Board,
2 Windsor Pl,
Cardiff. (R 496)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

ASSISTANT ENGINEER (ELECTRICAL MAINTENANCE) EARLEY GENERATING STATION SEC/3.97.

APPLICANTS should have had appropriate experience in a modern generating station. Manufacturing works experience will be an advantage. A sound technical training is essential and applicants should possess, or be studying for, qualifications leading to corporate membership of an appropriate professional institution.

Salary: N.J.B. Grade G.7, £950/£1,055.

Special application forms (not AE6/ACT) obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 9 Aug., 1960. (R 508)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

North Staffs Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (STOKE SOUTH DISTRICT)

Duties include the construction, operation and maintenance of H.V. and L.V. Mains and Substations up to and including 33 kV, and applicants should have had experience in the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £950/£1,055 per annum (N.J.B. Grade G.7).

Apply by letter within 14 days, stating age, experience, present position and salary to Mr C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

South Staffs. & North Worcs. Sub-Area

THIRD ASSISTANT ENGINEER (PLANNING AND OPERATIONS) (HEADQUARTERS)

Duties will include assisting with the planning of H.V. and M.V. systems. A wide experience of distribution methods is desirable, together with a good knowledge of protective gear. Experience in the planning and designing of power networks as applied to industrial and urban areas will be an advantage. Technical qualifications to H.N.C. level in electrical engineering or equivalent desirable. Salary £1,080/£1,215 per annum (N.J.B. Grade M.10).

Apply by letter within 14 days, stating age, education, qualifications, experience, present position and salary to Mr H. A. P. Caddell, Sub-Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

F. W. CATER,
Secretary.
(R 511)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Re-Advertisement

APPLICATIONS invited for the following superannuable N.J.B. appointments at USKMOUTH "B" POWER STATION, NR. NEWPORT, MON.

ASSISTANT ENGINEER (EFFICIENCY)

Vacancy No. 196/ET/60.

Salary: Schedule A, Class K, Grade 7, Scale 12, £1,155/£1,305 per annum.

ASSISTANT MAINTENANCE ENGINEER (MECHANICAL)

Vacancy No. 197/ET/60.

Salary: Schedule A, Class K, Grade 8, Scale 11, £1,080/£1,215 per annum.

Applicants should possess H.N.C. or equivalent qualifications and have had experience in a modern power station.

Previous applicants need not re-apply.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 12 Aug., 1960. (R 510)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

THIRD ASSISTANT ENGINEER
(SYSTEM PLANNING)
TECHNICAL DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 185/60.

APPLICANTS should hold a degree or the Higher National Certificate in Electrical Engineering.

Preference will be given to candidates who have experience of fault calculations, of switchgear and protective systems and the solution of problems involving simple a.c. theory.

Duties will include power system calculations, relay settings, preparation of system diagrams and operation of d.c. and a.c. calculators.

The salary will be in accordance with Class BX, Grade 8 (£925/£1,215 per annum), of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications: 12 Aug., 1960.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.
(R 528)

THE SOUTH WALES ELECTRICITY BOARD

Senior Demonstrator and Demonstrators

APPLICATIONS are invited for the following posts:

(a) SENIOR DEMONSTRATOR
SWANSEA DISTRICT
SALARY: N.J.C. Grade 2, £700/£775

(b) DEMONSTRATOR
NEATH DISTRICT

(c) DEMONSTRATOR
MERTHYR DISTRICT

(d) DEMONSTRATOR
PONTYPOOL DISTRICT

SALARY FOR (b), (c) and (d):
N.J.C. GRADE 1, £600/£700.

Candidates must be competent to give demonstrations and lectures in public halls, consumers' houses or showrooms on cooking, laundering or housecraft subjects. They should also have sales ability for showroom duties and a good knowledge of electrical appliances.

The qualifications required are the Diploma of a recognised Domestic Science College or the Demonstrators' Certificate and candidates should hold the E.A.W. Certificate.

The persons appointed will be required to take part in agreed rotas of Saturday working.

Applications stating age, qualifications, experience and particulars of present duties should be addressed to the undersigned at St. Mellons, Cardiff, so as to arrive not later than 12 Aug., 1960.

Envelopes should be marked:

(a) Senior Demonstrator—8/60.
(b) Demonstrator—87/60.
(c) Demonstrator—145/60.
(d) Demonstrator—146/60.

R. G. WILLIAMS,
Secretary.
(R 517)

SEYCHELLES ELECTRICITY DEVELOPMENT SCHEME

ENGINEER MANAGER

APPLICATIONS are invited for the above post with the GOVERNMENT OF SEYCHELLES. Appointment on contract for one tour. Salary according to age and experience in range £1,700/£2,000 a year. Gratuity at rate 10% of salary. Free passages. Liberal leave on full salary.

Candidates, preferably between 30 and 45 years of age, should possess at least H.N.C. in Electrical Engineering and must have had experience of following duties:

(1) Running Electricity Supply Office, including sound knowledge of consumers' accounts systems, tariffs, etc.;

(2) Operation, maintenance and installation of diesel engine generating plant (400 kW installed) and H.T. and L.T. distribution systems.

Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/51096/EE. (R 540)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of PRINCIPAL ASSISTANT (ORGANISATION AND METHODS) in the Audit and Organisation Section of the Chief Accountant's Department at Board H.Q.

Applicants should be qualified accountants or university graduates and have had considerable experience in office methods and procedures. The Board has an extensive programme of mechanisation in operation; knowledge of the application of machines and office appliances will, therefore, be an advantage.

The appointment will be subject to the conditions of the National Joint Managerial and Higher Executive Grades Committee of the Electricity Supply Industry and the salary will be within Grade 4 (Class C), £1,740/£1,940 per annum.

The successful candidate will be required to contribute to the Board's Superannuation Scheme, if eligible.

Apply by letter within 14 days giving full details of qualifications, age, experience, present post and salary to The Secretary, Midlands Electricity Board, Mucklow Hill, Halesowen, Nr. Birmingham.

F. W. CATER,
Secretary.
(R 498)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:

THIRD ASSISTANT DISTRICT ENGINEER
PLYMOUTH

Salary within Class G, Grade 9, Salary Scale 7, £845/£930 per annum, of Schedule A of the N.J.B. Agreement.

The successful applicant will be responsible to a Second Assistant District Engineer, and duties will include general mains work and supervision of underground cable laying; overhead line erection and substation construction; maintenance of overhead lines and underground cables; and switching on the distribution network at voltages up to and including 33 kV. He will be expected to carry out standby duties.

Previous similar experience and qualifications leading to the Higher National Certificate in Electrical Engineering are required, and possession of a current driving licence will be an advantage.

Applications to be made on standard form AE6/ACT, obtainable by postcard only, from the District Manager, South Western Electricity Board, 3 Elliott Rd, Prince Rock, Plymouth. Closing date for receipt of completed applications is Saturday, 20 Aug., 1960. (R 524)

LECTURER IN ELECTRICAL ENGINEERING

REQUIRED as soon as possible due to internal promotion at SOUTH EAST LONDON TECHNICAL COLLEGE, LEWISHAM WAY, LONDON S.E.4.

Salary scale £1,370 x £35—£1,550 plus London Allowance £38 or £51. Possible entry up the scale.

Application forms from Secretary at College (FE3/ET/1967/7), returnable within two weeks of advert. date. (R 506)

EASTERN ELECTRICITY BOARD

Fens Sub-Area

196/60.R.

ELECTRICIANS

VACANCIES for Electricians are occurring in the Newmarket, Cambridge, Huntingdon and St. Neots areas. Applicants should be skilled craftsmen experienced in domestic, commercial and industrial installations.

Rates and conditions in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry, the present rate being 5s 1½d per hour for a 42-hour five-day week.

Apply by letter to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 12 Aug., 1960. (R 521)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPOINTMENT OF ASSISTANT CHIEF COMMERCIAL OFFICER

APPLICATIONS are invited for the above appointment at Board Headquarters. Graded N.J.M. B.8 (Scale 5)—at present £2,360/£2,560 per annum.

Applicants should be suitably qualified, and have wide experience of industrial development, and a sound knowledge of modern techniques in the utilisation of electricity.

Duties of the post will include administrative control of the Board's Industrial Development Centre and the Test and Development Laboratory.

Appointment subject to medical examination. Pension Scheme.

Applications should be forwarded to the Establishments Officer, Merseyside and North Wales Electricity Board, Electricity Hse, Love La, Pall Mall, Liverpool 3. Closing date: 10 Aug., 1960. (R 522)

AIR MINISTRY

Works Designs Branch

REQUIRES in London and Provinces ENGINEERING DESIGNER DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution. Candidates should have served a recognised apprenticeship or had equivalent training and also have had practical experience. O.N.C. an advantage. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. Five-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted. Salary: in London ranges from £680 (at age 25) to £900 p.a. for men; from £673 to £868 for women. Somewhat lower in Provinces. Commencing salary dependent on age, qualifications and experience. Applicants, who must be natural born British subjects, should write to Air Ministry, W.G.d., Lacon Hse, Theobalds Rd, London W.C.1, or apply to any Employment Exchange quoting King's Cross 896, giving age, details of training, qualifications, full particulars of former posts held and copies of any testimonials. Candidates selected will normally be interviewed in London and certain expenses reimbursed. (R 283)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

FOURTH ASSISTANT ENGINEER
TRANSMISSION DEPARTMENT—KEADBY

APPLICATIONS are invited for the appointment as a Fourth Assistant Engineer, Keadby Transmission Section, nr. Scunthorpe.

Applicants should preferably have had some experience of the maintenance and operation of high voltage (132 kV and above), transmission systems and technical qualifications to Higher National Certificate standard.

The successful applicant will be required to reside in the Keadby/Scunthorpe locality.

The salary for the appointment will be in accordance with Grade 11, BX, Schedule B of the National Joint Board Agreement (£735/£990 per annum), and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 15 Aug., 1960. (R 526)

THE SOUTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT

APPLICATIONS are invited for the position of Commercial Assistant in the Pontardawe/Ammanford District in the Swansea and West Central Area.

Salary: N.J.B. Class F, Grade 7, Scale 8 (£890/£990).

Applications stating age, present position, present salary, qualifications and experience should be sent to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, Glam, so as to arrive not later than 12 Aug., 1960.

Envelopes should be endorsed "Commercial Assistant—147/60."

R. G. WILLIAMS,
Secretary.
(R 518)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Northmet Sub-Area

189/60.R.

(a) THIRD ASSISTANT ENGINEERS
HERTFORD AND ST. ALBANS
(Ref. 942 and 975)

(b) FOURTH ASSISTANT ENGINEERS
ENFIELD, ST. ALBANS, WEMBLEY AND WOOD GREEN
(Ref. 972, 963, 994 and 952)

(c) GENERAL ASSISTANT ENGINEERS
HERTFORD AND WEMBLEY
(Ref. 962 and 992)

Candidates for (a) and (b) should have had sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Candidates for (c) should have had a good general and technical education and possess the Higher National Certificate or an equivalent qualification.

Salary for (a) Hertford and St. Albans: N.J.B. Class G, Grade 9 (£845/£930).

Salary for (b) Enfield and St. Albans: N.J.B. Class G, Grade 11 (£745/£830), plus London Allowance for Enfield.

Salary for (b) Wembley: N.J.B. Class J, Grade 11 (£845/£930), plus London Allowance.

Salary for (b) Wood Green: N.J.B. Class F, Grade 11 (£690/£785), plus London Allowance.

Salary for (c) Hertford: N.J.B. Class G, Grade 12 (£690/£785).

Salary for (c) Wembley: N.J.B. Class J, Grade 12 (£800/£875), plus London Allowance.

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Apply by letter, by 8 Aug., 1960, to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet Hse, Southgate, London, N.14, quoting post applied for and reference number ON THE ENVELOPE.

Fens Sub-Area

191/60.R.
FOURTH ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
SUB-AREA HEADQUARTERS

The work involves the planning of schemes at L.V. and 11 kV over the whole Sub-Area and participating in the planning of extensions to the 33 kV system. A good background of technical training in distribution with qualifications of Grad. I.E.E. standard, is desirable, together with some knowledge of the preparation of switchgear specifications. The position offers an excellent opportunity for obtaining experience over a wide field of planning work.

Salary: N.J.B. Class K, Grade 12 (£845/£930).

Apply by letter to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 12 Aug., 1960.

Chilterns Sub-Area

192/60.R.
DEMONSTRATOR
BEDFORD DISTRICT

Candidates should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations including lectures and advice to consumers on the utilisation of domestic electrical apparatus. Previous experience in an Electricity Service Centre is desirable.

Salary: N.J.C. Grade 1 (£600/£700).

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 12 Aug., 1960. (R 520)

SOUTHERN ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER (Z.1231)

SOUTHAMPTON District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class H, Grade 11 (£800/£875 per annum). N.J.B. Conditions of Service.

The successful candidate will be required to give general assistance in the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications will be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

ASSISTANT ENGINEER (PLANNING) (Z.1233)

Salisbury District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class F, Grade 11 (£690/£785 per annum). N.J.B. Conditions of Service.

The successful candidate will be required to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications for either of these appointments on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting the appropriate "Z" number, not later than 12 Aug., 1960

ASSISTANT ENGINEER (PLANNING)

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class F, Grade 11 (£690/£785 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. net-

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works and to undertake standby duties if required. Suitable technical qualifications are necessary.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him quoting Z.1228, not later than 12 Aug., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (R 531)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

FOURTH ASSISTANT ENGINEER
TECHNICAL DEPARTMENT
(PROTECTIVE GEAR AND ELECTRICAL PLANT TESTING SECTION)

APPLICATIONS are invited for the above mentioned appointment with headquarters at Newcastle upon Tyne.

Applicants should have had experience in the testing and maintenance of electrical control and protective gear or the preparation of circuit diagrams for automatic schemes.

Technical qualifications leading to Graduate I.E.E. standard and experience in a manufacturer's works would be considered an advantage.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Class AX, Grade 9 (£840/£1.055 per annum), and will commence at a point commensurate with qualifications and experience

Forms of application may be obtained from the Assistant Regional Secretary (Personnel) Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 15 Aug., 1960. (R 527)

THE NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited for the following appointments subject to N.J.B. conditions of service. Applicants should be of H.N.C. standard in Electrical Engineering and have had some experience in either the design, construction or operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

THIRD ASSISTANT DISTRICT ENGINEER
DARLINGTON DISTRICT

Salary: Schedule A, Class F, Grade 9, £800/£875.

THIRD ASSISTANT DISTRICT ENGINEER
STOCKTON DISTRICT

Salary: Schedule A, Class G, Grade 9, £845/£930.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (R 530)

LONDON ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

APPLICATIONS are invited for the above position. Initially the successful candidate will be located at 84 Romford Rd, Stratford, E.15.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the Electricity Industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £610 per annum rising to £745 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, London E.C.2. Please quote ref.: PER/V/2933/T. (R 525)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

ASSISTANT SHIFT CHARGE ENGINEERS
HIGH MARNHAM POWER STATION
Vacancy No. 180/60.

APPLICATIONS are invited for the position of Assistant Shift Charge Engineer at High Marnham Power Station, near Newark, Notts.

Applicants should have had a sound technical training and practical experience in a large modern generating station. Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical or Mechanical Engineers.

The salary will be in accordance with Class M, Grade 8 (£1,245/£1,410 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 5 Aug., 1960.

SHIFT CHARGE ENGINEERS
HIGH MARNHAM POWER STATION
Vacancy No. 179/60.

Applications are invited for the position of Shift Charge Engineer at High Marnham Power Station, near Newark, Notts.

Applicants should have had a sound technical training and considerable experience in a large modern power station. The possession of the Higher National Certificate or equivalent would be an advantage.

The salary will be in accordance with Class M, Grade 6 (£1,445/£1,605 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 5 Aug., 1960.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)
COVENTRY POWER STATION
Vacancy No. 176/60.

Applications are invited for the position of Assistant Maintenance Engineer (Electrical) at Coventry Power Station, Alderman's Green, Coventry.

Applicants should have received a thorough technical and practical training, with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class G, Grade 8 (£890/£990 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Aug., 1960.

STATION SHIFT CONTROL ENGINEERS
WILLINGTON POWER STATION
Vacancy No. 184/60.

Applications are invited for the position of Station Shift Control Engineer at Willington Power Station, Willington, nr. Derby.

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National standard.

Salary will be in accordance with Class L, Grade 10 (£1,010/£1,130 per annum), of the National Joint Board Agreement, plus 10% Shift Allowance.

Closing date for receipt of applications: 12 Aug., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned, and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.
(R 529)

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

Second Advertisement

CASTLEFORD DISTRICT
DISTRICT SENIOR CLERK

THE successful applicant will be responsible for all clerical work in the District including stores, collection of accounts, meter reading and commercial records.

Possession of a recognised qualification will be an advantage.

Salary: N.J.C. Grade 7, £1,250 x £35—£1,355 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 12 Aug., 1960.

No. 7 (Grimsby) Sub-Area

SECOND ASSISTANT ENGINEER
(GENERAL DEVELOPMENT AND STREET LIGHTING)

Applicants for the above vacancy should possess the Higher National Certificate in Electrical Engineering. The candidate appointed will be responsible to the Senior Assistant Engineer (Commercial). He will be responsible for the overall planning and development of domestic commercial and small industrial supplies, the implementation of street lighting policy throughout the Sub-Area, and the overall supervision of the Grimsby District Contracting Section. A sound knowledge of the design and layout of floor-warming and block storage space heating schemes is essential.

Salary: Class K, Grade 7 (Scale 12), £1,155/£1,305 per annum.

GRIMSBY DISTRICT
CONSUMERS' ENGINEER

Applicants should possess at least the Ordinary National Certificate in Electrical Engineering. The candidate appointed will be responsible to the Second Assistant Engineer (General Development and Street Lighting), for the organisation of development in respect of domestic, commercial and small industrial loads and the control of the Service Centres and Sales Representatives in the Grimsby District. He will be required to supervise and conduct the negotiation of space heating schemes within the Grimsby District and should thus possess a sound knowledge of space heating techniques, including floor-warming and block storage schemes.

Salary: Class H, Grade 7 (Scale 10), £1,010/£1,130 per annum.

ASSISTANT CONSUMERS' ENGINEER

Applicants should have a good commercial training, and have had experience in negotiating with consumers for new and increased supplies and be able to give advice on tariffs and the use of electricity generally to domestic, commercial and small industrial consumers. The duties will also include supervision of outside sales staff and demonstrators. He should also be able to deal with consumers' complaints and disputes. Possession of a technical qualification will be an advantage.

Salary: Class H, Grade 10 (Scale 7), £845/£930 per annum.

LINESMEN (OVERHEAD POWER)
(UP TO 30,000 VOLTS)

Applications are invited for the above position in the Grimsby District.

N.J.I.C. conditions of service and rate of pay, the present rate being 4s 11½d per hour for a 42-hour five-day week.

SCUNTHORPE DISTRICT
CONSUMERS' ENGINEER
GENERAL DEVELOPMENT

Applicants should possess at least the Ordinary National Certificate in Electrical Engineering. The candidate appointed will be responsible to the District Commercial Engineer and must be capable of organising the development of domestic, commercial and small industrial supplies. He will be required to supervise and conduct the

continued in next column

continued from previous column

negotiation of space heating schemes, and a sound knowledge of the design and layout of floor-warming and block storage heating schemes is, therefore, essential. He will also be required to conduct negotiations for street lighting schemes in the Scunthorpe District.

Salary: Class G, Grade 8 (Scale 8), £890/£990 per annum.

GAINSBOROUGH DISTRICT
CONSUMERS' ENGINEER
(GENERAL DEVELOPMENT)

The candidate appointed will be responsible to the District Commercial Engineer and must be capable of organising the development of domestic, commercial and small industrial supplies. He will be required to negotiate space heating schemes and a knowledge of floor-warming and space heating schemes is, therefore, desirable. A technical qualification will be an advantage.

Salary: Class E, Grade 8 (Scale 6), £800/£875 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 12 Aug., 1960.

No. 1 (Bradford) Sub-Area

KEIGHLEY DISTRICT
INSTALLATION ENGINEER

Applicants must have a sound and practical experience in electrical contracting work of all types. They must be capable of preparing and supervising schemes for all classes of domestic, commercial and industrial installations, including specifications, estimates and tenders. Applicants must have had considerable experience in the control of workmen. The holding of an appropriate technical qualification by persons with the above experience will be an advantage.

Salary: N.J.B. Class F, Grade 8 (Scale 7), £845/£930 per annum.

S.A.H.Q.
SENIOR DRAUGHTSMAN
(CIVIL AND BUILDING)

Applicants should have had a good general and technical education in architecture and building construction and in the design of small buildings, office alterations, etc., and in the drawing up of specifications and bills of quantities for this class of work.

Salary: N.J.B. Present Scale 6, £800/£875 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 12 Aug., 1960.

No. 2 (Huddersfield) Sub-Area

COMMERCIAL ASSISTANT
(COMMERCIAL CATERING DEVELOPMENT)

The duties of this post require a comprehensive knowledge of trade practices and electrical equipment used by commercial caterers and bakers. The successful applicant will be exclusively engaged on the active development of load in this class of consumer.

Salary: N.J.C. Grade 3, £780 x £25—£880 per annum.

COMMERCIAL ASSISTANT
(AGRICULTURAL DEVELOPMENT)

The duties of this post require a comprehensive knowledge of electrical equipment used for agricultural and horticultural premises. The successful candidate will be exclusively engaged on the active development of load in this class of consumer.

Salary: N.J.C. Grade 3, £780 x £25—£880 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 12 Aug., 1960. (R 523)

CENTRAL ELECTRICITY GENERATING BOARD
Southern Division
MAINTENANCE ENGINEER
(MECHANICAL)
EARLEY GENERATING STATION

APPLICANTS should have had considerable experience in the maintenance of generating station mechanical plant, and must be capable of controlling staff and planning and supervising mechanical plant maintenance.

Candidates should be corporate members of an appropriate professional institution or hold qualifications leading to such membership.

Salary: N.J.B. G.7, £950/£1,055.

Special application forms (not AE6/ACT) obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 10 Aug., 1960. (R 519)

A NUMBER of progressive vacancies for ELECTRONIC TESTERS exist with the A.E.I. Instrumentation Division. Practical experience of data processing equipment or similar type of work is essential. O.N.C. level or equivalent required. Apply giving full details to the Personnel Officer, A.E.I. Instrumentation Division, P.O. Box 1, Harlow, Essex. (R 538)

APPLICATIONS are invited for a SENIOR ELECTRICAL ACCESSORIES REPRESENTATIVE for London and the Home Counties Area. Preference will be given to the applicant who is well introduced, and has a first-class knowledge of the trade. Salary, commission, car and superannuation scheme. — Apply S. O. Bowker Ltd. (Tenby), 19/21 Warstone La, Birmingham 18. (R 543)

ASSISTANT TEST ENGINEER for new Testing Laboratory dealing with electrical wiring accessories, cartridge fuses, etc. Applicants should have at least O.N.C. or equivalent, and have had previous experience in a similar capacity. A good salary will be offered according to age, experience and qualifications. Applications treated in strict confidence if addressed to Technical Manager, M.K. Electric Ltd., Shrubbery Rd, Edmonton, N.9. (R 433)

A TECHNICAL REPRESENTATIVE required by substantial electrical contracting firm to call on architects, consultants, builders, etc., in Eastern Counties. Knowledge of installation work an advantage. Successful applicant will be required to ultimately live in Norfolk or Suffolk and will have opportunity of further advancement with progressive organisation. Possibility of ultimate directorship for capable man of pleasing personality who can create goodwill and secure enquiries.— Box No. 7939, Electrical Times. (R 502)

MANAGER

required by

MANUFACTURER OF
DOMESTIC ELECTRIC APPLIANCES

for Service Depot situated in
Co. Durham.

This is a new senior appointment with superannuation scheme available. Successful applicant will be fully responsible for the expansion and efficient function of all activities of the Depot. Previous association with this industry and electrical apprenticeship with O.N.C. (Elec.) preferred, but essential quality required is for successful management.

Applications in own handwriting, giving full particulars of qualifications and previous experience to:

SERVICE MANAGER
TRICITY COOKERS LTD.
SERVICE DIVISION
ELVEDEN PL, LONDON N.W.10
(R 501)

CABLE MANUFACTURER
in
AUSTRALIA
requires
PLASTICS AND RUBBER CHEMISTS

Applications are invited from chemists, preferably under 35 years of age and experienced in either or both rubber and plastics insulation of cables, for appointment as Technical Officers with a large Australian company which manufactures a very wide range of cables.

These are senior appointments and the conditions of employment will be attractive.

Applicants, who will be required to migrate to Australia, are asked to provide full details of their academic qualifications, training, experience, salary required, and also a recent photograph.

Applications should be addressed to:

Personnel Manager,
OLYMPIC CABLES PTY. LTD.
Box 33 P.O., West Footscray
Victoria, Australia
(R 532)

A VACANCY occurs within this rapidly expanding organisation for a HEATING SALES ENGINEER familiar with floor-warming, for the Southern Home Counties area. Salary, commission and expenses will be paid. Apply in writing to Heating Investments Ltd., 284 Regents Park Rd, London N.3. (R 462)

CONTRACT ACCOUNTANT required to carry out billing and other accountancy work in connection with electrical contracting. Pension and bonus schemes in operation. Applications, stating details of age and experience, to Drake and Gorham (Contractors) Ltd., 36 Grosvenor Gdns, S.W.1. (R 503)

POWER STATION CHEMISTS

Qualified and experienced Chemists required for the Power Stations of the Electricity Supply Commission in the Transvaal and Orange Free State, South Africa.

Generous emoluments according to qualifications and experience. Excellent service conditions including liberal leave. Good prospects of advancement to men of ability, energy and initiative.

Rail and sea passages will be provided for selected applicants, their wives and minor children, subject to agreement to serve the Commission for at least three years.

Chief Chemist from South Africa will interview selected candidates in London. Apply in writing to:

The London Representative,
ELECTRICITY SUPPLY COMMISSION
723/737 The Adelphi
John Adam Street, W.C.2. (Ref: E/263/4)
(R 500)

CONSULTING Engineer requires ELECTRICAL ENGINEER/DRAUGHTSMAN, aged 20/25 to assist in the preparation of installation design on projects mainly large and interesting, including Universities, Hospitals, Commercial Development and Industrial expansion schemes, etc. Minimum qualifications O.N.C. Meal vouchers and superannuation scheme. Applicants must state age, educational background, qualifications, experience and salary required. G. H. Buckle & Parners, 2 Harrington Gardens, London S.W.7. (R 514)

DESIGN ENGINEER for senior position with Electrical Engineers in Westminster. Applicants must have experience of Commercial and Industrial Installations and Instrumentation Systems and be capable of designing to customer's requirements, including preparation of Specifications.

Applications stating age, educational background, qualifications, experience and salary required to Box No. 7941, Electrical Times. (R 515)

ENGLISH ELECTRIC

Whetstone, Nr. Leicester

ELECTRICAL DISTRIBUTION

An electrical engineer is required for work associated with the design of nuclear power station electrical distribution systems, cabling, special supplies and control equipment.

The work, which is very varied and calls for initiative and personal responsibility, consists of the design of electrical installation systems, production of ordering specifications and schedules, and liaison with other departments and outside suppliers.

The successful applicant will have served an apprenticeship in the contracting industry and will be qualified to at least H.N.C. level.

The appointment is permanent and pensionable. The Company offers excellent working conditions in rural surroundings and assistance with initial accommodation.

Enquiries, which will be treated in confidence, should give details of age, qualifications, experience and current salary, and be addressed to the

Technical Staff Officer,
Dept. G.P.S.,
Marconi House, Strand, London W.C.2,
quoting reference ET 1896L.
(R 505)

PILKINGTONS

WORKS ELECTRICAL ENGINEERS

At Kirk Sandall, near Doncaster, Pilkington Brothers Limited are engaged on a £4,000,000 capital development extension including the latest version of the Pilkington invented "twin grinder" licensed to flat glass manufacturers throughout the world.

A WORKS ELECTRICAL ENGINEER is required to take charge of the department of over 100 men responsible for the design, construction, maintenance and instrumentation of the wide range of electrical equipment required for the supply and operation of large scale continuous processes.

At St. Helens, due to internal promotion, a similar vacancy has arisen in the Commonwealth's largest sheet glass works with electrical consumption of the order of 28,000,000 units per annum.

These are responsible positions affording ample scope for initiative and responsibility. Opportunities for promotion are available in other works' production or maintenance departments, in technical development and in central engineering and planning.

If you have a good honours degree in electrical engineering and maintenance experience, you are invited to write about yourself to the Personnel Officer (Graduate Recruitment), Pilkington Brothers Limited, St. Helens, Lancashire.

The greatest name in the world of GLASS

(R 442)

DRAUGHTSMAN required for Consulting Engineer's office, to assist in the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to: J. Roger Preston and Partners, 15 North Audley St, W.1. (R 541)

ESTIMATING/SALES ENGINEER required. Applicants must have had experience of preparing tenders for Diesel Engine Generator sets up to 200 kVA. Good salary and excellent prospects—Hampson Industries Ltd., West Bromwich. (R 341)

ESTIMATING ENGINEER, with experience of estimating installation contracts, required in the Westminster Office of Electrical Engineers and Contractors. Pension and Bonus Schemes in operation. Applications, stating details of age and experience, to Box No. 7935, Electrical Times. (R 465)

ELECTRICAL ENGINEER (aged 25-35) for supervising and estimating electrical contracting work. Apply in writing giving experience, technical education, age and salary required to A. Anderson and Son (Electrical Engineers) Ltd., 100 Grange Rd, Middlesbrough. Applications will be treated with the strictest confidence. (R 439)

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have a vacancy for an

INSTRUMENT MECHANIC

The work involves installation and maintenance of indicating, recording and controlling instruments for process air conditioning and power station operation.

This position is organised on a shift basis where the average take out, after a short preliminary period, is £18 10s. In addition a merit rating scheme is in operation. The Company has approximately 5,500 employees at its Harrow factory and runs non-contributory sickness and pension plans.

Please write:

Men's Personnel Department, Kodak Limited (Factories), Wealdstone, Harrow, Middlesex.

(R 535)

ELECTRICAL ENGINEER required for Glasgow Office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension scheme. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (R 513)

ELECTRICAL ENGINEER required for Consulting Engineer's office, to carry out the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to: J. Roger Preston and Partners, 15 North Audley St, W.1. (R 542)

FOREMAN, E.H.T., L.T. CABLE JOINTER, London area. Must be conversant modern jointing methods and able to control labour. Current driving licence essential. Superannuation and Sick Pay Schemes.—Box No. 7937, Electrical Times. (R 466)

'ENGLISH ELECTRIC'

FUSEGEAR DIVISION

who manufacture a wide range of switchboards and distribution equipment incorporating H.R.C. fuses, have a limited number of vacancies for experienced

SALES AND CONTRACTS ENGINEERS

at their Liverpool Works. These appointments command a good salary, are permanent and pensionable with life assurance benefits after a short qualifying period. There are excellent opportunities for promotion and advancement for keen young electrical engineers interested in making a career with the Company.

Outside Technical Representatives for both Home and Overseas territories are appointed from the inside Engineering staff from time to time after completion of an initial period in the Works.

Qualifications required are H.N.C. or equivalent, together with sound practical training and experience in (a) industry, (b) electrical contracting or (c) electricity supply. Applications will also be considered from more junior engineers who are at present in the final year of study for the H.N.C. in electrical Engineering but who do not have commercial experience. In such cases training will be given. Generous assistance with removal and housing expenses will be given to successful candidates. Please write giving full details of qualifications and experience to Dept. G.P.S., Marconi House, Strand, London W.C.2, quoting reference ET497E

(R 269)

BICC

TECHNICAL ASSISTANT

required for work on transmission problems in connection with overhead line and substation work. Applicants should not be over 26 years of age and preference will be given to holders of the Higher National Certificate in Electrical or Mechanical Engineering. Candidates with O.N.C. and Drawing Office experience will, however, be considered.

Excellent working conditions and salaries. Permanent status including Pension Fund membership after satisfactory probation. Staff restaurant. Five-day week.

Applications in writing to:

Personnel Officer
BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 Bloomsbury Street, W.C.1.

(R 534)

ELECTRICAL DESIGN ENGINEERS AND DRAUGHTSMEN

APPLICATIONS are invited from qualified Electrical Design Engineers and Draughtsmen to work on nuclear and special engineering development projects in the fields of power distribution and automatic control. The positions are permanent and pensionable and offer a progressive career with the Company.

The Offices occupy pleasant accommodation in a modern building adjacent to Paddington Station.

If you would like to discuss these vacancies with us, please write giving full details of experience, age, etc., to:

The Office Manager,

JOHN BROWN (S.E.N.D.) LIMITED

20 Eastbourne Terrace,

London W.2.

(R 533)

LIFT ENGINEER required by Insurance Company for inspection of lifts. Must have served apprenticeship with lift construction firm and hold at least O.N.C. or equivalent in Electrical or Mechanical engineering. London. Starting salary: £800 p.a., pension, widow's pension, etc. Write with full details to Box ET.697, LPE, Romano Hse, 399-401 Strand, W.C.2. (R 536)

PROGRESSIVE electrical manufacturing company have vacancy for a man of initiative in SALES OFFICE. Experience in export procedure and/or as representative an advantage. Good prospects. Pension scheme. Write full details in confidence to: Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. (R 427)

SOUTHERN IRELAND—WORKS ENGINEER required by large city factory. The Works Engineer will be responsible to the Works Manager for the maintenance of plant and buildings, and supervision of a small drawing office and workshop. This appointment offers considerable variety and experience, and calls for an imaginative man, preferably with a flair for design and electrical work. The broad requirements are a Mechanical or Electrical Engineering Degree, membership of I.E.E. or I.Mech.E., with considerable experience. Age 25 to 40. Starting salary: £800/£1,200 p.a., depending on experience. Contributory pension scheme. Apply with full details of education, qualifications and career in strict confidence to Managing Director, Box No. 7929, Electrical Times. (R 383)

SALES REPRESENTATIVES required for the London area. We have two vacancies for representatives to operate in the London and adjacent areas. Experience in switchgear, transformers and their application desirable. Applications stating age, experience and salary required, should be addressed to: South Wales Switchgear Ltd., 19 Woburn Pl, London W.C.1, marked "Representative." (R 539)

SUPERVISING ELECTRICAL ENGINEER experienced in estimating for industrial and public authority installations. Progressive position. Pension scheme. Write full details training and experience in confidence to: Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. (R 428)

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WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP: also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (R 1)

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A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (R 9)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (R 3)

BROOKS 60 h.p. a.c., 3-PHASE MOTOR, 580 r.p.m., complete with starter equipment, slide rails, pulley and 20 ft belt drive. Enquiries to Senior and Godwin, Chartered Surveyors, Sturminster Newton (Tel.: 244), Dorset. (R 537)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4, Stores at Chobham, Surrey. (R 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (R 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (R 8)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeen Area

SURPLUS EQUIPMENT FOR SALE
MERCURY ARC RECTIFIERS

OFFERS are invited for the following surplus equipment at present located at Aberdeen:

H.V. SWITCHGEAR: Three-panel Switchgear and Cowans 150 MVA, 6.6 kV Switchboard comprising incoming 400 amp oil immersed isolator and two 300 amp oil circuit-breakers.

RECTIFIERS: Two 350 kW Hackbridge glass bulb mercury arc rectifiers for either a 420 volt or 530 volt 2-wire d.c. supply.

TRANSFORMERS: Two 595 kVA, 6,600/503/420 volts. Tapping range of ±2½, 5 and 7½%.

D.C. SWITCHBOARD: Two 800 amp Bertram Thomas high-speed circuit-breakers, etc.

Equipment purchased June, 1938.

Full details, Tender Forms, Conditions of Acceptance and permission to view may be obtained from the undersigned with whom offers in sealed envelope, marked "Scrap Tender No. 109/11/8," should be lodged not later than midday on Thursday, 11 Aug., 1960.

J. E. WHITTAKER,
Area Manager.
North of Scotland Hydro-Electric Board,
Millburn St,
Aberdeen. (R 504)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings. 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (R 6)

SECOND-HAND Electrical Plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Pk, Middlesex. Telephone: Wembley 3121: Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (R 10)

EDUCATIONAL

GUARANTEED COACHING for CITY AND GUILDS EXAMINATIONS—Electrical Engineering Practice: Electrical Installation Work and Illumination Engineering. Also many practical non-examination courses. No books to buy. Write for FREE Prospectus, stating subject, to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. (R 368)

INDISPENSABLE TO WORKS MAINTENANCE ENGINEERS

ELECTRICAL FAULT DIAGNOSIS

A quick guide to trouble finding in all classes of industrial electrical equipment. Tables specially classified according to defects in plant giving causes of trouble and action required.

Tables cover a.c. motors, d.c. machines, a.c. generators, rotary converters, bearings, transformers, mercury arc rectifiers, starters and switchgear and fluorescent lighting.

Price **15/-** *Post Free*

Send order and remittance to Publishing Department, The Electrical Times Ltd., Sardinia House, Sardinia Street, London, W.C.2.

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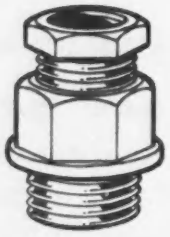

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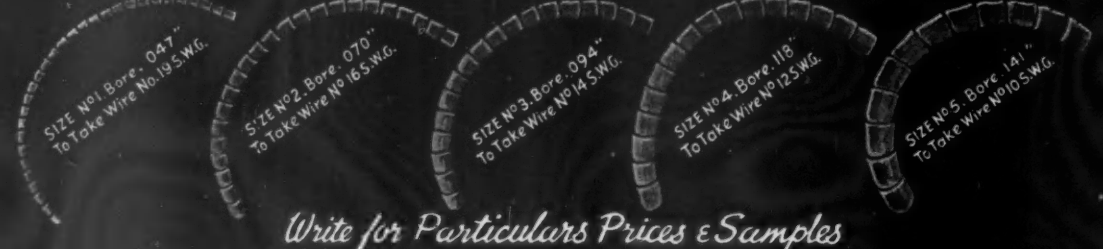
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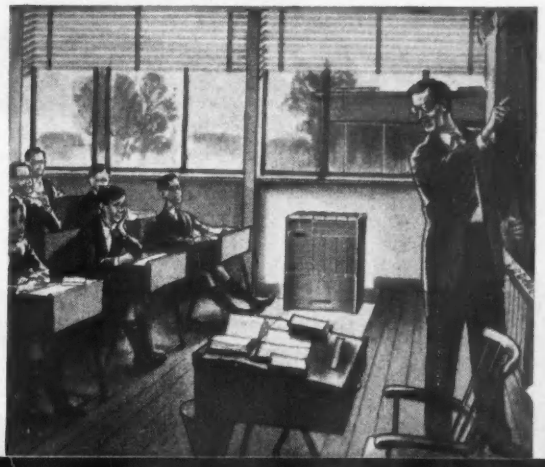
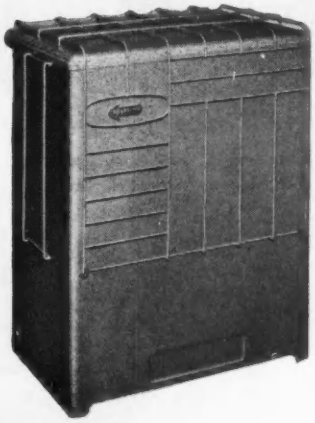


Nightstor Heaters



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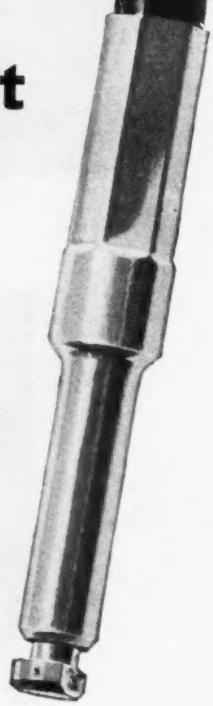

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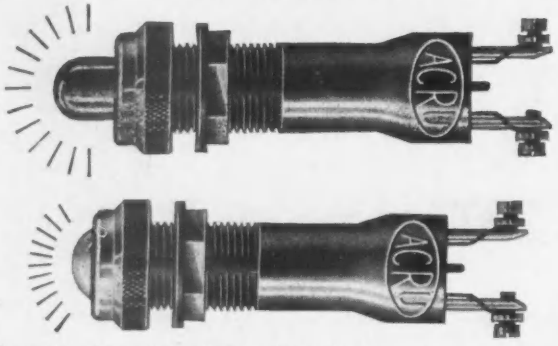

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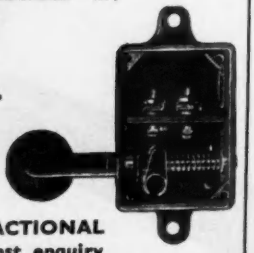

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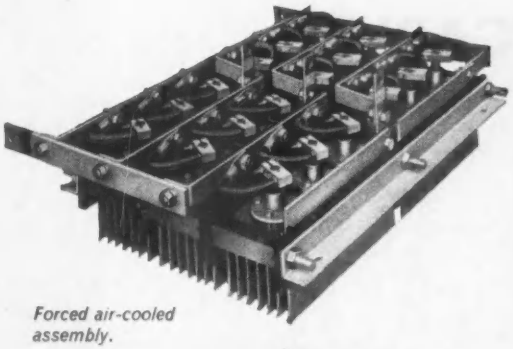

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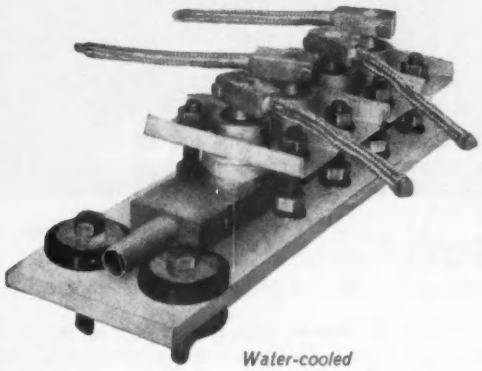

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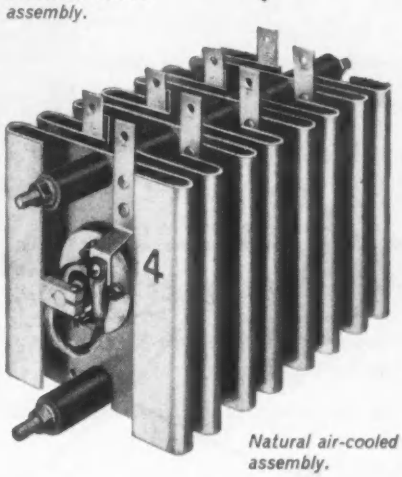

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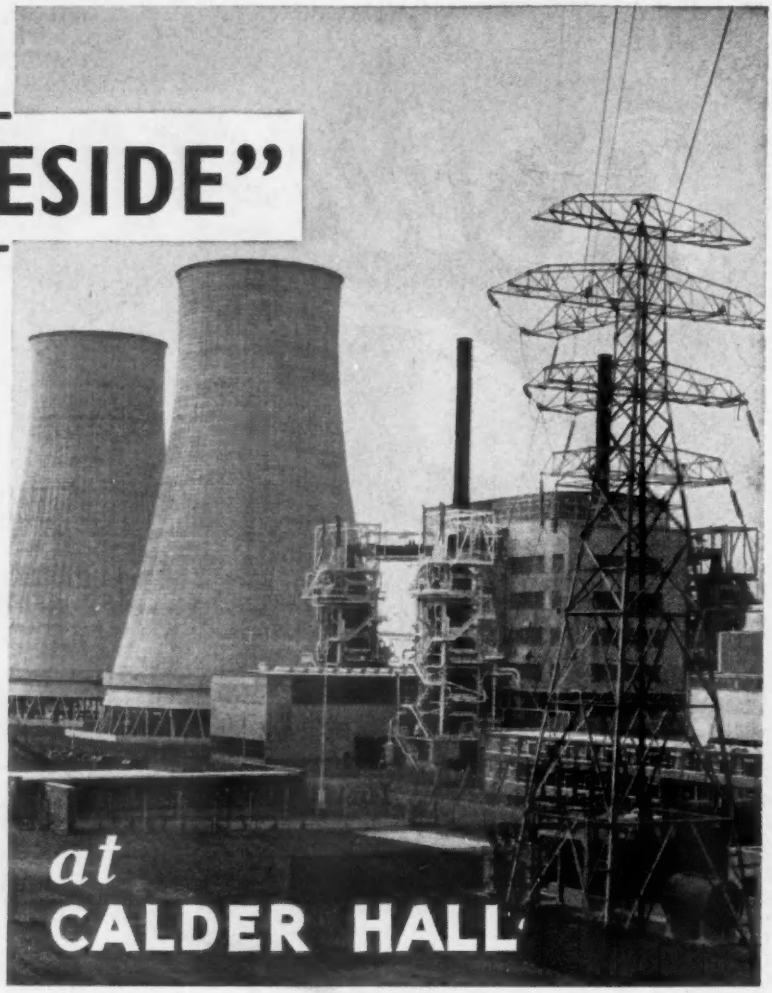

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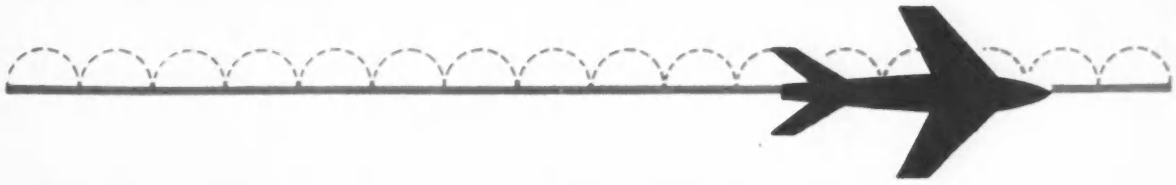

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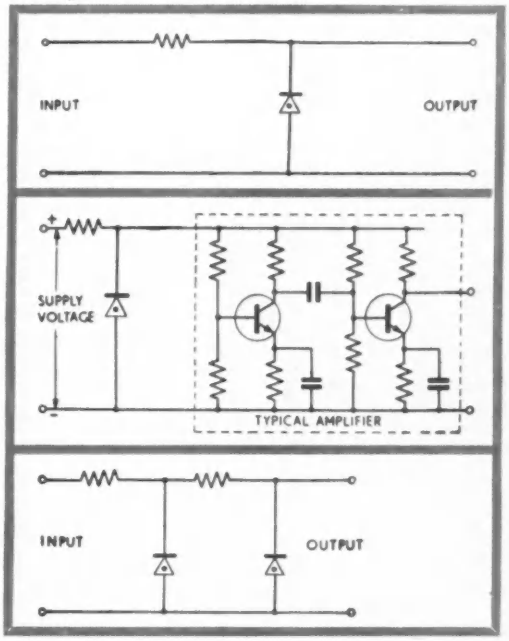

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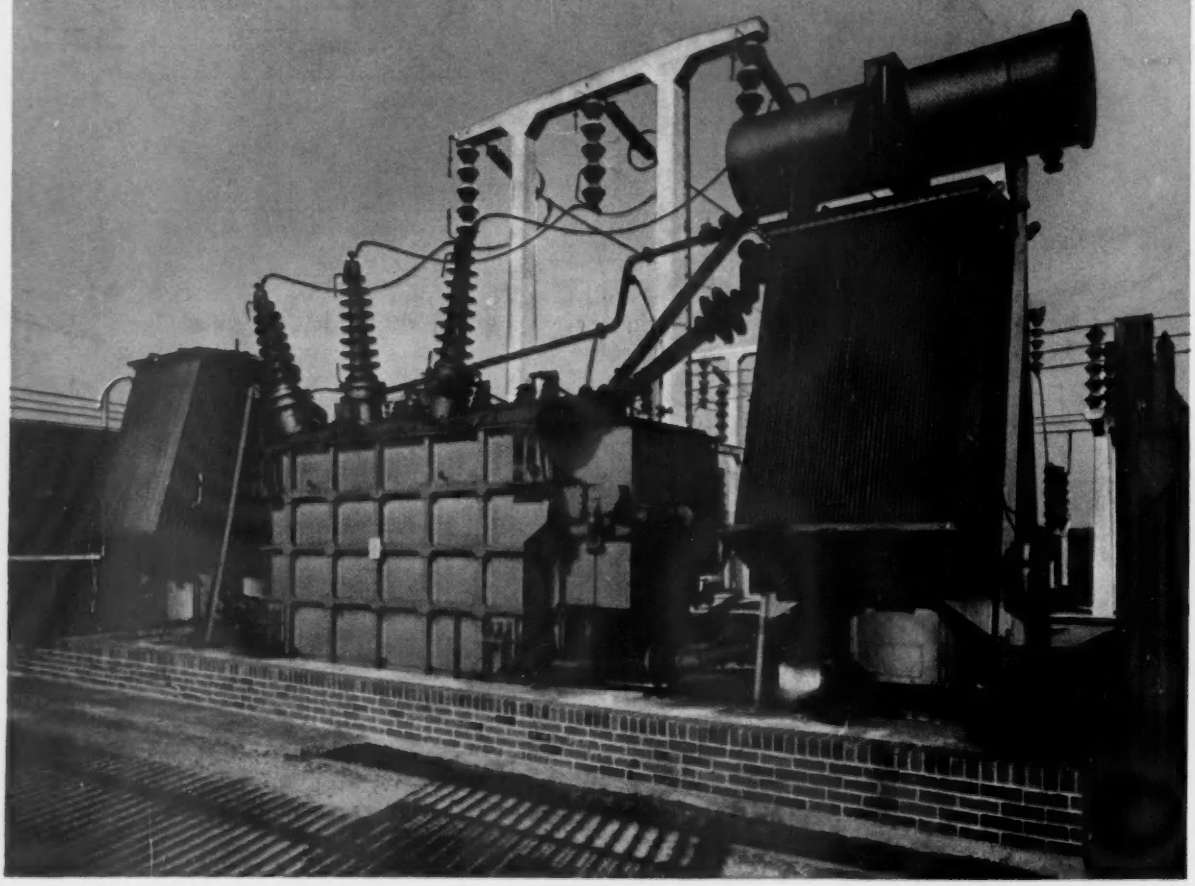

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